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THE

MINING MAGAZINE:

DEVOTED TO

Mines, Mining Operations, Metallurgy, &c., &c.

EDITED AND CONDUCTED BY

WILLIAM J. TENNEY,

AIDED BY

STEPHEN P. LEEDS AND AUGUST PARTZ.

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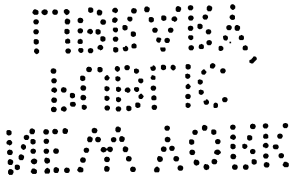

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VOL. III.—JULY, 1854.—No. I.

Art. I.—THE VENTILATION OF MINES AND COLLIERIES.*—By John Phillips, F. R. S.

The districts of Northumberland and Durham, in which coal is found, occupy a large part of these counties; but of this great area the portion formed by the mountain limestone or lead measures, (about two-thirds), and that covered by millstone grit, yield but small supplies of coal, though in some places, especially in shales, they are productive of ironstone. The total thickness of the coal series (including the millstone grit, to the top of the little limestone) was given by Mr. W. Forster in his mining section at nearly 1,600 feet. Of this thickness coal makes about 50 or 60 feet, or one-thirtieth part.

The vertical section of the coal and ironstone series of Northumberland and Durham, including the millstone grit, presents the following beds of coal, of which scarcely any but the lowest seams are continuous over all the tract of the Tyne, Wear, and Tees; though almost every one has been found workable in some part or other. The inclination of the strata is, in a general sense, eastward, and, though very moderate, sufficient to render almost inaccessible near the seacoast the lowest beds of the series. The pits in the extreme eastward range have already reached the depth of 1,800 feet; but the beds are here so nearly level that, except for the purpose of reaching lower seams (which is not likely to happen), this may be esteemed nearly the utmost depth that will be realized. The heat at this great depth is considerable (at Monkwearmouth it is 86° in the workings); the fire-damp is not less abundant; the area to be wrought from one pair, or one system of shafts, becomes greater, in order that the enormous expense of these shafts may be repaid; and thus all things concur to render these deep eastern collieries more especially worthy of the application of all the resources of capital and skill.

* Presented to both Houses of Parliament by command of her Majesty.

The lower coal strata rising westward are exposed in so many dales and round the edges of so many hills as to have been easily traced, opened, and worked by the "old men." It was in these western tracts (I believe) that the working of coal in the Newcastle district first commenced. The superior quality of the high main (the uppermost good seam) near Newcastle drew away the trade; but as this and other good seams of the upper and middle coal series have become occupied by many establishments, capital and enterprise have again flowed to the west and north-west, and the lower coal seams have been opened afresh. Old wastes accordingly are met with; old pillars left by former coal-owners are discovered, and removed or abandoned; and the ventilation and drainage are sometimes affected by cutting into old levels and underground roads. Under such circumstances ancient plans become very valuable; for want of them water may be encountered in excess, or a barrier of unnecessary breadth left because of uncertainty.

The abundance of crop workings; the ample exposure of the strata at the surface; the moderate depth of the coal seams below the surface; are circumstances which give to the western collieries a nearly entire immunity from fire-damp; choke-damp ("stythe") is perhaps rather more frequent in them than in the collieries farther east, excepting such as are established on a particular seam called on the Wear the "Five-quarter" coal.

The most persistent of the coal seams are, as in Yorkshire and Derbyshire, of the lowest groups in the millstone grit, and in the series next above that rock. In the middle part of the series the Hutton seam of the Wear (Low main of the Tyne) has a great range, the High main a comparatively small extent. The quality of the seam varies with the district. The Hutton seam, for example, yields a fine house coal on the Wear, and superior steam coal in the country north of the Tyne, but in the immediate vicinity of this last-mentioned river it is of an indeterminate quality, though approved in the gas works. The High main, Bensham seam, and Hutton seam, have been found very fiery coals according to the locality; the Five-quarter seam on the Wear is remarkably otherwise, and rather disposed to yield stythe (carbonic acid gas). The issue of fire-damp takes place from the fresh-cut face of coal by the innumerable small fissures due to the cleavage or "cleat," a structure of great importance for the arrangement of the underground excavations. Larger fissures are found occasionally to yield correspondingly larger streams of gas; and in the vicinity of slip dikes (faults) discharges are generally looked for, and they have proved often so considerable as to give origin to the title of "blowers" and "bouks" or "bags" of gas. The extrication of gas is on such occasions rather rapid. In the course of 1846, a blower which was cut in Walker Colliery yielded so much gas as to "foul" a

portion of the mine 641 yards long, and containing 86,306 cubic feet, in a few minutes. Jets likewise burst up from the "thill" (floor) of coal-beds, and bring (usually with water) either the gas of that coal, or what is yielded by a seam beneath.

There is no district in the kingdom where the desire of abundant ventilation is more strongly felt, or more energetically carried out, than in the country which adjoins the rivers Tyne, Wear, and Tees. The deep collieries could not possibly be worked at all without the aid of artificial and powerful means of producing air currents; the shallower collieries could not be worked so extensively without the adoption of similar means; fire-damp and choke-damp almost everywhere require to be expelled, and the result is an almost universal employment of ventilation force. The efflux of gas may, so far as it is regular, be rendered quite innocuous by sweeping the working faces with strong and constant streams of fresh air; but the irregular discharges from jets or blowers have been found so large, as in some cases to overmatch the ventilation, impregnate the air to a dangerous degree, and generate explosion. The wisest precautions are required to meet these dangerous issues of gas. By borings kept well ahead toward the lines of "slip dikes," the discharges which might suddenly empty these large gas-holders, are sometimes rendered slow, regular, and easily manageable; the gas being, occasionally, with safety, lighted, and actually burnt away. By similar means, viz., boring through the thill, or sometimes into the roof, as the works proceed, gas channels become established on which pipes may be fixed, so as to exhaust, by a long and slow discharge, the gas which has been treasured up in the adjoining fissures. If these methods fail, and the gas-jets be thought unconquerable, and the works are to be prosecuted, the Davy lamp must be exclusively used under strict and rigorous discipline.

It is hardly possible to feel greater confidence of safety in any situation, than while traversing, candle in hand, the main galleries of a well-ventilated mine; there is no sign of fire-damp; pure air flows in a full steady stream, which in a moment extinguishes the incautiously held light; and its cooling effect is fully equal to that of a moderate wind. As we proceed along the minor galleries, after one, two, or more "splits" of the current, and enter the working "bords,"* this feeling diminishes, the air-stream is more languid, the warmth augments, the fire-damp issues silently, or with a slightly hissing or tinkling noise, by myriads of minute threads or bubbles, and we remember that except there be fifteen times as much atmospheric air, as of the inflammable gas at every point of the working space, explosive

* This is the usual miner's spelling of a word whose meaning, now become technical, is derived from the board-like structure imparted to coal by vertical fissures, called cleat, sline, back, &c.

combustion may ensue. It is at the working faces where the hewers are toiling to undercut the seam,* with lights brought near to the issuing and resounding gas, that the necessity of a strong, equal, unintermitting pressure upon the air, to force it through the indirect and abruptly angulated passages of the mine, is fully impressed upon the mind. When, in the fresh headings of a fiery mine, we hear the gas at every crevice, and see it bubbling up in large quantity from small pools and wet places in the thill at intervals of a few fathoms, it scarcely needs the splendid experiment (often made) of lighting the gas, so as to cover the coal with a sheet of pale flame, or excite a more violent blaze on the floor, to testify to the importance of the safety lamp, which, while enlarging its own flame to give warning to the prudent, refuses to kindle the atmosphere around it, and thus often prevents the dreadful fate which one rash or ignorant miner, or one negligent manager, might bring upon a hundred souls. By what has been said, it appears that the extensive working of coal, in the deep fiery mines of the north of England, is accompanied essentially with circumstances requiring on the whole more vigilance and precaution than in Derbyshire and Yorkshire, taken generally.

But we have been speaking of the whole coal; it is still more the case in the broken. When the pillars left at some former period are to be removed, candles are rigorously excluded in well-managed collieries; for the difficulty of commanding and keeping a good clear ventilation is so great, that even the small quantity of gas yielded by the pillars (which are surrounded, and, in fact, drained by old air passages), and the uncertain and irregular additions from the falling roof, heaving thill, and breaking ground around, render the lamp indispensable. In such situations it is possible to breathe and work, while the lamp is filled with flame, but in every well-managed mine such an experiment is forbidden. Finally, when the passages which remain open through the waste, and touch upon the fallen materials which constitute the mysterious recesses of the goaf,† are traversed by the wastemen, the lamp alone is trusted.

It is saddening to reflect that powerful ventilating currents of air, and safety lamps, which, under judicious management, offer an almost impregnable guard against danger, have not been always so employed as to afford constant protection against explosion. Accidents have happened, from known and unknown causes, in the best-managed collieries, and there is certainly an impression rather general, among intelligent viewers, that they must still be counted as among the ineradicable obstacles to the satisfactory and profitable conduct of a great colliery in a fiery

* This operation is called "kyrving" in the Newcastle district.

† This word, goaf, equivalent to the gob of Midland Counties, seems to have a Cymraic origin in ogof, a cave or hollow.

seam. Before adopting this conclusion, let us survey more in detail the mode of working; gather examples of the evolution of gas under different circumstances; discuss the methods of ventilation; and inquire into the precautionary discipline of the mine.

GENERAL VIEW OF THE WORKING PROCESSES AS AFFECTING THE EXTRICATION AND ACCUMULATION OF FIRE-DAMP AND CHOKE-DAMP.

Though, as might be expected, the great and numerous collieries of the northern district, sunk to various depths, to seams of different thickness and quality, lying flat or variously inclined, much or little broken by slip dikes, and traversed irregularly by whin dikes, offer a large variety of mechanical combinations to meet special cases, as bratticed shafts, two, three, or many shafts, self-acting planes, engine-planes worked from the surface, or by high-pressure steam below, there is an approach to general conformity in the methods and contrivances, according to which the coal is actually got, and brought from the working places to the main roads, and ultimately delivered at the surface.

The order of the operations is this:—the coal is cut and got by hewers; it is then moved in the tubs through the first passages by putters; horses draw several of these tubs to the shaft-foot, or to stations on the main roads, according to the plan of the colliery; and their labor is completed by the steam-engine. Only one of these processes (that of the hewer) has any direct or collateral effect on the extrication of gas, but they all have an important bearing on the plan of the underground roads and the methods of ventilation. The roof which overlies the cavities made by hewers may have a tendency to fall in, and pour inflammable gas into the roadways or air channels; the thill or floor may be subject to heave and discharge gas upwards; there may be in front of the workings, especially along lines of dislocation, undiscovered reservoirs of such gas; it may accumulate in the broken ground or goaf, which, once abandoned, is almost never explored again; all these are to be expected, occasionally, as consequences of the advancing excavation; but the main source of inflammable gas in the northern collieries, that which yields by far the greater, though (with good ventilation) not the most dangerous supplies, is the cutting of the fresh coal in the ordinary process of everyday work.

The method of getting coal now employed in the districts of the Tyne, Wear, and Tees, varies considerably from that formerly practised in the same parts, yet rather in degree of development than in essential points. The basis of the method is unchanged. It is to excavate straight parallel passages of a constant width, and to connect these at regular intervals by

headings or cross courses usually of smaller dimensions. The former passages (boards or bords) are essentially for getting the coal, and are commonly driven across the grain, fibre, or cleat of the coal;* the cross cuts are essentially for circulation of air along the boards, and for roads.

The rectangular blocks of coal left between these passages were at first, and still are, regarded as posts or pillars to support the roof. In the earliest workings they were suffered to remain and bear up the ground; afterwards they were reduced and weakened (technically robbed) as much as was judged convenient, before being left and abandoned. The latest method that is now followed, is to leave them untouched so long as their use is needed for support, but afterwards to remove them entirely, so as to allow the ground to fall, and make extensive goaves. In the first state of workings there was but one operation, the excavation of bords and headings; what would now be called working in whole coal; at a later time there was added to this the robbing of the pillars; and now there is a separate and regular removal of them, constituting a peculiar and interesting operation called pillar working.

The ancient practice is still to be seen in operation at Derwent Main, a colliery of early date, west of Newcastle, established on a seam of coal of the unusual thickness of 7 feet (Hutton Seam). The headway courses, along which the coal is transported from the working bords, are 30 yards apart. The bords are 4 yards wide, and are separated by pillars of only one yard across, except at the side of the headways, where they are left much stouter, to secure the road. These pillars are not removed, but remain to support the roof and the ground above. A considerable extent of ground has thus been formerly worked by the old men at Mickley and other collieries of no great depth in the districts west of Newcastle. The modern working at Mickley is analogous to what is now generally practised.

The first stage of the modern work differs from the above chiefly in the proportions of the parts. The pillars have frequently the same length, but they are universally wider, that is to say, the wall left between bord and bord is thicker.

In the shallow collieries about Medomsley, there are workings with pillars of a character intermediate between the ancient and modern; thus at Holmside, in five-quarter seam, we have pillars 28 yards long, 8 yards wide, or to the wall; alternating with 4 yards bords. In the Auckland district, we have at Black Boy Colliery, in five-quarter seam, 30 yards pillars, and 8 yards walls, to 4 yards bords. In Eldon Colliery, the upper seam (five-quarter) has pillars 25 to 30 yards, walls 12; while, in the seam

* This is the general rule: but bords are sometimes driven systematically in the headways course, or parallel to the cleat, and sometimes in a direction oblique to the cleat.

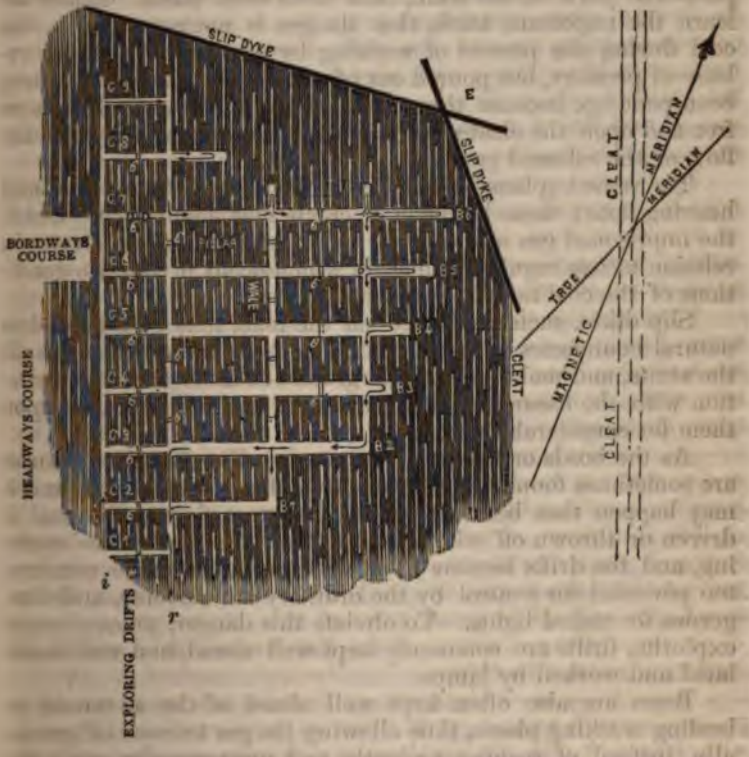
below (main coal), the pillars are 40 yards, and walls 16; the bords in each case 4 yards.

The older workings at Heugh Hall have pillars 20 yards, walls 5 to 7, bords 3 yards, and headways 2.

At Monk Wearmouth the Bensham workings have pillars 24 yards by 16 yards, and in the Low Main, at the great depth of 1800 feet, the pillars are 24 yards by 18.

We may now inquire what is the effect on the extrication of gas by this, the first process, or *working in whole coal.*

EXPLANATION OF THE ORDINARY DISCHARGE OF GAS.



The sketch above given (E) is intended to explain the *ordinary* discharge of gas. The spaces shaded by lines in a N.N.W. direction, are undisturbed coal, the lines themselves represent innumerable small, nearly vertical fissures, giving to the coal the structure called cleat; the open spaces parallel to these lines are excavations in the coal called headways (usually 2 yards in

width); those which cross these and the cleat at right angles are wider excavations (often 4 yards in width), called boards or bords. The rectangular masses of coal left entire between these spaces are posts or pillars; the term pillar being applied specially as a measure to the longer side of the mass parallel to the bord (20, 30, or more yards), and the term wall to the shorter side (often 12 yards) parallel to the headways and cleat. The coal is commonly more easily and economically excavated in the bords than in the headways. Stopping are marked | 6. Doors D. The bords are marked B 1, B 2, &c.

It is found as a matter of experience, that in driving bordways course, whatever gas exists in the coal comes off more freely from the numerous fissures which are cut across, than in the headways course which runs parallel to them, and opens only a few limited channels. It also issues more freely from particular parts of the seam, than from other parts. Hence we learn the important truth, that the gas is not generated in the coal during the process of working by admission of air, or release of pressure, but poured out of cavities, in which it has long been pent up, because these cavities are laid open. The more free and open the cleat structure, the more easy and regular the flow of the released gas.

The same explanation applies to the cases of falling roof and heaving floor; these lay open or create new channels, by which the imprisoned gas may escape; and it is still more important in relation to less regular discharges which occur in the two conditions of the coal now to be noticed.

Slip dikes, such as marked on the plan, may be regarded as natural boundaries of the works; they cross and cut through all the strata, and make great underground channels of communication with the fissures of the cleat, so as to act like drains upon them for considerable spaces.

As the bords or headways approach a dike, the cleat fissures are sometimes found more productive of gas than usual, and it may happen that before reaching the great fissure, the coal is driven or thrown off with violence from the face of the working, and the drifts become filled with an inflammable mixture, too powerful for control by the ordinary air currents, and dangerous for naked lights. To obviate this danger, precautionary exploring drifts are commonly kept well ahead, and well ventilated and worked by lamps.

Bores are also often kept well ahead of the advanced or leading working places, thus allowing the gas to come off gradually, instead of rushing violently and unexpectedly upon the men employed in hewing. A barrier of coal may be left parallel to the dike, if its course be known, and the use of lamps may be enjoined in all the working places of the district. Whether known beforehand or not, the danger from slip dikes may be always diminished, and in a good degree guarded against, by well-arranged exploring drifts and the safety-lamp. Occasionally

in the ordinary course of work there is found a band of partially crushed (danty) coal, (such as often lies parallel to a slip dike or whin dike,) without dislocation, which offers more numerous and more open channels than usual, and consequently delivers more gas.

The quantity of gas which escapes from the cleat, danty coal, and sides of a slip or whin dike, follows no regular law, but varies with locality and circumstances. I am indebted to Mr. Easton for a measure of the quantity which was delivered from a working bord, under peculiar circumstances, in Hebburn colliery (Bensham seam). This seam is often rather fiery, and not less than usually so at Hebburn; but in this colliery it comes in an unusual manner, without any sign of moisture, and without the characteristic sound which is a useful warning to the miner. To show that these two things are mutually related, Mr. Easton made a very satisfactory experiment. I was standing close to the working face, after remarking that my Davy lamp fired frequently, and might have been kept in continual explosion, though not the slightest sound could be heard. Water was then thrown abundantly on the face, and immediately the small tinkling, whispering sound of escaping gas was heard; it was continued whilst moisture remained, and renewed on fresh application of the liquid.

In this bord the gas was allowed to accumulate and displace, or mix with the atmospheric air, of which the usual flow was stopped for the purpose. The result, as tested by the Davy lamp, was a gradually extending inflammable mixture, which was distinctly measurable in the drift, and was measured. It amounted, in the period of two hours, to 1,500 cubic feet of inflammable mixture. The ignition of such a quantity of air would be sufficient to produce a terrific explosion; a much smaller quantity (owing to the enormous expansion during combustion, and the enormous collapse which follows it) would have been very destructive. But this quantity was purposely allowed to accumulate for experiment, and only extreme negligence or misfortune could have allowed it to become dangerous; the ordinary current of air, well directed, being more than abundantly sufficient to dilute and dissipate it.

The quantities of gas which come off from the bands of danty coal (without dislocation) are extremely unequal, and soon spent; they have not, so far as I am aware, been measured. Mr. Potter assures me that large quantities were thus yielded in exploring drifts at Murton (Hutton Seam).

But some facts have been recorded of the volumes and pressures of gas yielded by extraordinary eruptions, which it will be useful to consider. We are indebted to Mr. G. Clark for a full account, with illustrative drawings, of two eruptions of fire-damp which entered the drifts of Walker Colliery (Low Main Seam),

from a slip dike ranging N.N.W., which was approached from the east. This full account has been given in a report on the Gases and Explosions in Collieries, by Sir H. T. De la Beche, Dr. Lyon Playfair, and Mr. W. Smyth, p. 49.

The first was experienced November 13, 1846. On this occasion a mass of coal was displaced 8 feet long on one side, 4 feet on the other, and nearly 6 feet high. This, with the disintegrated or danty coal which slipped from the dike, must have weighed about 11 tons. A discharge of fire-damp ensued; the two men working in the place secured their lamps, (one of which had been partially covered with the fall of coal, but continued to burn, the other nearest the issue of gas had been put out,) drew down the wick of that which continued to burn, hastened to apprise the other men in the pit, extinguishing the lamps as they proceeded, and finally retired to the shaft. (This is according to the rules of the colliery.)

The extent of the airways which were observed to be fouled at the same time, was about 41,681 cubic feet. (The foulness may have extended farther north.) After 15 to 20 minutes, there were no longer any traces of fire-damp. The air moved in this part of the mine at the rate of 6·24 feet per second, and the quantity which passed in one minute was 10,483 cubic feet.

A second discharge, from a different point of the same slip dike, took place on 10th December, 1846. The dike was now cautiously approached by boreholes, kept ahead of the working face, the last borehole had not only reached, but passed through the dike into the coal beyond; no discharge of gas ensued, even where the hewers had excavated coal beyond (on the rise of) the dike, till a portion of the roof was taken down. Then the danty coal was displaced above where the borehole passed, a violent noise was heard, like the blowing off of steam, and a heavy discharge of gas came off, which fouled the air courses for 641 yards in length, and an area of 86,306 cubic feet. At 400 yards from the point of efflux, a deputy met the foulness, saw his lamp fire, and drew down the wick. The gas continued to burn in it for 10 minutes, making it red hot, and then went out. At 641 yards from its source the foulness was met by four men and boys, who immersed their ignited lamps in water. The foulness, though not observed farther, probably extended farther. The air was circulating at the rate of about 5½ feet in a second, and the quantity was about 16,000 cubic feet in a minute. After 12 or 15 minutes, there was no longer any appearance of gas, except near the point of issue of the blowers. The gas came off warmer than the air at the place. The Davy lamp, which on these occasions saved the mine from explosion, has been used exclusively in Walker Colliery since the accident in 1817. The men who used it were worthy of it, and the regulations of the mine deserve every commendation.

In sinking the Ann and Jane shafts at Walker Colliery, the extraordinary tension force which the fire-damp possesses in its underground reservoirs, was most strikingly shown. In both cases a considerable quantity of solid freestone was moved up, with immense discharges of fire-damp. At both places explosions still happen on putting a light to the side of the shaft.

Mr. Forster has given me the following example from the Low Main coal of Seaton Delaval:—

"Though not of frequent occurrence, blowers have occasionally been met with. The first of any consequence came off on the 2d November, 1843; which, on being pricked by the hewer's pick, immediately took fire at his candle, and could not be extinguished. It being found impracticable to insulate the bords adjoining, they were all barred off together, and remained so for six weeks, at the expiration of which period they were opened out and found to be completely filled with carburetted hydrogen, which, by measurement, was found to occupy a space of 48,000 cubic feet.

"After this tract was cleared of its noxious mixture and work resumed, the hitch leader continued to emit gas for some time, though at a much slower rate, until finally it died away altogether. From that time to the present no blowers of any magnitude have been met with.

"But although in the ordinary circumstances and state of the mine fire-damp is rarely seen, still there is abundant proof that it is constantly given off at the faces of the coal; and were it not for the brisk current of air diluting it so thoroughly as to render it harmless, its effects would, no doubt, be frequently felt."

The regular flow of fire-damp from the surfaces of coal appears soon to diminish, and for the most part ceases in the drifts which divide it; but on a large scale coal is found to give off great volumes for considerable periods of time. In an unpublished communication with which Mr. T. J. Taylor has favored me, I find that he has determined the quantity given off from the Bensham Workings, in Percy Main, when the water pressure on these drowned workings was diminished, so as to allow of the imprisoned gas to rush up the shaft. It was not less than 12,824,575 cubic feet of gas at ordinary pressure, which had sustained a pressure of 4½ atmospheres, and preserved its inflammability to the height of at least 70 feet from the shaft top. Large as this quantity appears, it is in reality very trifling when compared with the ventilating power now employed in the collieries on the Tyne and Wear, only a little exceeding the quantity of air which passes through Hutton Colliery in one hour. This body of gas was the accumulation of nine months, from a surface of ,1272,700 square yards = 263 acres, or 48,762 cubic feet per acre in nine months = 180 cubic feet per day per acre.

In Wallsend Colliery, a portion of goaf, 50 acres in extent, was barred off from the workings, and furnished with a discharge-pipe to the surface 6 inches in diameter. This pipe has never ceased to yield a full stream of gas, which has been kept lighted at the top of the pipe. It appears to be slowly diminishing in quantity, successive measures having formerly given 95

cubic feet per minute to the late Mr. Buddle; and lately 74 cubic feet, in the same time, to Mr. G. Clark, who has provided me with ample details on this subject, and to whom I look with confidence for some further interesting experiments. One of these relates to the pressure under which the gas exists in the barred-off district: a pressure subject, no doubt, in some proportion, to that of the atmosphere, but not completely nor immediately. This barred-off district appears to be full of gas.

In the Pesspool drifts of Haswell Colliery (a pair of exploring drifts), a discharge of fire-damp took place under remarkable circumstances, which the comments of Mr. T. J. Taylor, to whom I am indebted for the account, have rendered very instructive:—

"Along these drifts 9,760 cubic feet of air were passing in each minute through a sectional area in the back-drift of 37 square feet, with a velocity of 4·39 feet per second. Safety-lamps were used in the face. While the hewer was working in the usual manner in the back-drift he heard a loud noise, and immediately retreated to the face-stenting, where he heard a sound like that of falling water, occasioned by the rushing out of the gas at the face. The air current which circulated in these drifts having, as the phrase is, 'nothing to do,' was employed, after passing through them, in ventilating a district farther out bye,* where the men worked with candles. The deputy of the way immediately ran to warn these men to extinguish their lights: he then returned and went through a door leading to the back-drift 310 yards from the face where, with his safety-lamp, he found the air course foul from top to bottom. With much judgment he kept this door open; and as the greater portion of the air current then passed by the shortest run, the progress of the mass of fiery atmosphere was not only thus nearly stopped, (technically laid dead,) but the current passing through the door mixed with and diluted it (the source being now exhausted) below the firing point. In less than half an hour not a trace of gas was to be found either on the face of the drift or in the district."

Mr. Taylor estimates the volume of gas thus suddenly poured forth at 3,000 or 4,000 cubic feet, and the mass which it rendered foul (inflammable) 35,000 feet. This quantity, slowly delivered, would have been easily mastered and rendered innocuous by the current of 4·39 feet of air in a second: but coming off in one outburst, it would not have been conquered by the strongest current which could by any means have been forced through the drift, but must have been borne along, carrying danger with it, through all its course. How admirable, under such conditions, appears the safety-lamp, and how well was it seconded by the exertions of the officer in charge of the district. The gas was sufficient in quantity, thus given off, as Mr. Taylor justly observes, to account for the heaviest pit explosions which have occurred in the north of England; one unprotected light would have caused such an explosion, and such lights there were on the course of the inflammable air. Fortunately they were extinguished in time; and we have an instructive proof of the

* In bye and out bye are expressions for farther inward and farther outward.

danger of deviating from the maxim that air which has ventilated drifts or districts worked by lamps, should never afterwards pass by naked lights.

"There were three small troubles in advance of this back-drift, where the blower was met with, yet the fore-drift had already passed through the same faults, without falling in with the blower; so uncertain is the discharge as regards locality, and so vague must be, under these circumstances, the effect of a system of drainage, unless carried out in a very minute degree.

"After passing through the faults in the fore-drift, without anything particular occurring, we yet met with a violent issue of gas from the same faults, and in the parallel drift only 12 yards distant.

"No trace of fire-damp remained after this great eruption had expended itself; in less than half an hour the face was quite clear."

Without citing other examples we may safely conclude, from the cases now given, coupled with the general experience of the district, that the process of working in whole coal releases and drains off, for the most part regularly and in manageable quantities, most of the fire-damp which exists, ready formed, in the coal; but exceptional instances occur, especially in the vicinity of dislocations of the strata, where uncommon accumulations of the gas are met with. This gas exists in the coal in a state of considerable tension, so as to burst out, rending the coal, and throwing down large masses in its course, in quantities which overpower the strongest air current, and create fearful danger through great lengths of the underground channels. It is in exploring drifts (pushed forward in pairs beyond the rest of the works), and in the most advanced of the working bords and headings, that the chance of meeting with these eruptions of gas is greatest. The best methods of avoiding evil consequences are —1. To keep these exploring drifts well ahead of all the workings; 2. To employ in them safety-lamps exclusively; 3. To approach dislocations, by cautious borings ahead; and 4, and most important of all, to give clear instructions beforehand, and secure their efficiency by constant and intelligent superintendence.

[To be Continued.]

ART. II.—THE PROPERTY OF THE CATAWBA MINING COMPANY, IN McDOWELL COUNTY, NORTH CAROLINA.—BY PROF. J. G. ELLERY.

SIR,—I have, during the past month, made an extended examination of the property known as the Tate Mine.

TOPOGRAPHY.

The tract upon which it is situated is in McDowell county, N. C., and lies upon the waters of North Muddy Creek, a fine affluent of the Catawba River. It is situated about 18 miles from

Morganton, the county seat of Burke county, and about six miles from Marion, the county seat of McDowell. An adjoining tract, known as the Caleb's Branch tract, and across which the veins on the Tate tract extend, has recently been added, embracing in all an area of over a square mile, with the extension of the North Carolina Central Railroad to Tennessee, as now surveyed, running across it.

The general surface of the country is undulating. The deep valleys impart to it, however, a moderately hilly aspect, when viewed without reference to the whole, owing to the small streams or "branches," as they are here termed, having worn down their beds deep in the highly decomposed auriferous slates—a feature peculiar to the geology of this State. The rich valley of the Catawba stretches along about two miles to the northwest, and a little more than double that distance beyond the horizon is bounded by the loftiest part of the Blue Ridge and its accompanying chains, attaining an elevation on Mount Mitchell, or the Black Mount, as it is called here, of 6,476 feet—the highest land in the United States east of the Rocky Mountains. A few miles in an opposite direction the view is also bounded by the South Mountains, a high spur of the Blue Ridge.

This proximity to the mountains, in addition to the value it imparts in the picturesqueness of scenery and salubrity of climate, is also valuable in a geological point of view: for it was the eruption and elevation of the greenstone forming the Blue Ridge which metamorphosed, tilted up, and filled with veins, the now gold-bearing slates of the lowlands along its flanks, and gave exit from below to the sulphurets filling the veins, of which, reasoning from all known mining countries, only a small number in comparison with those to be met with at moderate depths extend to the surface. For examples of this we need only allude to the greenstones and granite of the Hartz, the porphyries of the Saxon Erzgeberg, and the "elvans" of Cornwall—three of the most classic mining districts of Europe.

In an agricultural point of view the soil is of the same deep red argillaceous nature so generally met with in this State, producing all the cereal grains. And as to the healthfulness of the climate, its elevation and proximity to the mountains speaks for itself.

The Tate tract contains 332 acres, of which only about 20 acres are under cultivation, the remainder being still the primeval forest consisting of several species of oak, chestnut, hickory, pine, and the tulip tree (Liriodendron tulipifera), here called the poplar. Thus it will be perceived that there is abundant timber for mines and machinery, and charcoal for fuel for a long time. There is also a dwelling-house and orchard upon it. Two considerable streams, the Tate and Meadow Branches, flow through it, furnishing a never failing supply of water. Upon the Mea-

dow Branch is a fine "shoal," or rapid, affording an ample fall, and water for the erection of machinery, the latter requiring only to be conducted from its channel, along the side hill to the requisite point, as is the case for the stamping-mill now standing with all its appurtenances.

The Caleb's Branch tract lies immediately contiguous to the above tract on the west, and comprises 317 acres, of which about one-half is timbered, consisting of the same varieties as on the above tract. A fine stream, the Caleb's Branch, also passes through this. Both tracts together, therefore, comprise 649 acres.

GEOLOGICAL FORMATION.

The geological formation is that of the metamorphic, or pyrocrystalline slates, or in other words the gold-bearing primary slates, but merging so insensibly into one another, or rather presenting a union in greater or less proportions of all the elements of these rocks, as rarely to be referable to any one of the normal types into which these slates have been subdivided. In general, however, they may be comprehended under the talco-micaceous and hornblende varieties—the former often merging into a quartzose nature, or quartzit, with less mica and talc, succeeded by a stratum where the mica and reddish talc predominate with small garnets, and infinitely small crystals of magnetic iron. Occasionally a stratum has its mica replaced by micaceous or specular iron. The latter, or hornblende slate, however, generally maintaining a more uniform character, often contains more or less mica in fine black scales, not observable till after decomposition. Its surface, too, after exposure to the weather, is often observed to be traversed by two series of fine quartz veins crossing one another at an angle so as to divide it into rhombic figures, with small octahedra of magnetic iron disseminated through it. This slate appears to be the most highly auriferous in this section of the slate, for in many places the soil derived from its decomposition is "sluiced," or washed with advantage, as high up the declivities as water can be obtained for that purpose. Slates from this tract have yielded me by amalgamation at the rate of from 20 cents to $3 per ton, a fact, however, of more theoretic than practical value. These slates too, especially the former, are generally decomposed, or partially so, to great depths. In the adits, some of which attain a depth of 80 feet, I observed as far as I could enter, which was near to the galleries along the vein, that decomposition had still penetrated to that depth, so as to render a pickaxe the only tool necessary for excavating it.

The eruptive force which metamorphosed and elevated these slates has left them in a highly inclined position, but apparently without any dislocation or "slides." They maintain, with slight

variations, an average strike of about N. 45° E., and S. 45° W., coinciding with the general bearing of the Blue Ridge, with a variable dip to the S. E. averaging about 70° from the horizon. There is another geological feature which also merits remark, not alone in a theoretic point of view, but more especially in a practical one, for it has a direct bearing upon a long established fact observed in mining, that in general the greater the number of eruptions or disturbances which have taken place, the greater the amount of metallic wealth in the veins, or, in other words, the greater opportunity offered for the ascent of the metallic sublimations from below. Now in passing along the adits may be observed many veins like bands of kaolin or porcelain clay, as white as snow, between the strata of slate, varying from half an inch to several inches in thickness, but perfectly conformable to their stratification. These were once small veins of graphic granite where the feldspar greatly predominated, now decomposed to the above substance by a well known chemical change. The same rock is often observable in the surrounding country, capping or visible on the sides of the "knobs;" but so decomposed and cellular, from the kaolin having been partially washed away, leaving the other component element, the quartz, generally colored by the iron from the beds of this ore, with which it is so often associated, as to resemble at first sight some of the ancient scoriæ or trachytic lavas of the tertiary era. True, granite is not generally a metalliferous rock of itself to any extent, save of tin; neither are the greenstones and granite of the Hartz, the porphyries of Saxony, or the serpentines of Tuscany, only valuable in this connection as conductors of the metals to the surface. Thus we find then, here, at least, two epochs when this may have taken place; but which of them was the younger may not be inferred with certainty from one observation in an unexplored country like this; but the inference is in favor of the granite, from its apparent intrusion after the elevation of the slates by the greenstone.

THE METALLIFEROUS VEINS.

Of these there are several, in all, probably five; but, owing to the great depth of soil and leaves, together with the difficulty attending such a work in forests intersected by valleys, this could not be ascertained with certainty. But from the bearings of those which could be traced continuously, and the several outcrops of the others, they can be reduced with tolerable certainty to five, as will be seen by reference to the accompanying topographical map, made by Mr. J. A. Bagley, a very talented young engineer, from a survey on the spot.

Vein A, or the "Tunnel Vein," has an average bearing of N. 41° E.; dip at the surface of 75° to the S E.; width, on an average, 18 to 20 inches. Traced by outcrop 128 rods, of which 100 were on the Tate tract.

Vein B, or "Stamping-Mill Vein," has an average bearing of north 48° 50′ east; stands about perpendicular; width, 20 inches; traced, 13 rods. Its course, judging from its bearing, lies along the bed of the Tate Branch, for a long distance hidden by the detritus from the workings of the gold deposits along its bed. Distance from Vein A, 14 rods. Lies on the Tate tract.

Vein C, or "Branch Vein," has an average bearing of north 43° east; average width, 14 inches, with a dip of 65° to the south-east; length, as traced by trenching along its course, 18 rods. Lies on the Tate tract as far as traced. Distance from the Stamping Mill Vein, 15 rods.

Vein D, or "Tulip-Tree Vein," bearing north 42° east; dip, about 75° to the south-east; width, where opened by a trench beyond the Tate Branch, 20 inches; in other places along its course 12 to 18 inches. Visible on the surface 200 rods, 154 of which are on the Caleb's Branch tract. Distance from the "Branch Vein," 19 rods.

Vein E, or "East Vein," has a bearing of north 41° east; dip, 70° toward the south-east; is a small vein with a width of 8 inches; length, 22 rods, as far as traced by trenching. Lies on the Tate tract. Distance from the "Tulip-Tree Vein," 10 rods.

The probability however is, that this zone of veins, comprised within a space of 58 rods in width, will be found at a short distance below the surface to merge into *two powerful and rich veins*, the Tunnel and Tulip-Tree Veins. Analogy also favors the supposition, together with the apparent tendency toward it. These veins, maintaining the same general parallelism and uniformity of bearing, depart from it however for short distances more or less. Neither is the width uniform, at times narrowing down to a few inches, and again attaining a width of several feet. Fine advantages of working them, if desired, by adits, down to water-level, in most places to nearly 100 feet, are offered. And also of working the pumps in the shafts by water-power, at a slight expense compared with steam, by cutting adits from the Tate Branch for that purpose; at least on the Tunnel Vein is this the case.

The veinstone is quartz, possessing a greasy lustre and saccharoidal structure; when compact the color is generally white, often, however, of a yellowish tint. Near the surface, often incloses large fragments of slate. Often full of innumerable honeycomb cavities, left by the decomposition of the former sulphurets, or partially filled by the decomposed matter derived from them, or again, which is often the case, these cavities contain nothing but native sulphur, without a trace of the metals formerly in union with it. I have sometimes obtained from the interior of large blocks pieces of compact crystalline native sulphur, slightly mixed with partially decomposed galena—pieces three or four

inches in diameter. Iron and copper pyrites, with galena, or the sulphurets of iron, of copper, and of lead, occur in all the veins at the surface, more or less, but more particularly in greater quantities in the Tunnel, Stamping-Mill, and Tulip-Tree Veins. In the larger veins a stratum of "brown ore," as it is called, or decomposed iron pyrites, very rich in gold, accompanies them on one side adjoining the slate. I have never observed coarse gold in the quartz of the veins, but the deposits along the branches on both tracts, especially on the Caleb's Branch tract, along the branch from which it takes its name, were very rich. The gold was very coarse, or in large particles, and was found in greatest abundance immediately below the crossing-place of the veins, decreased in quantity immediately above, until near the next vein above, and ceased entirely above the uppermost vein.

THE DEPOSITS.

In this connection some mention of the deposits along the branches must not be passed over unnoticed. The Tate Branch has been worked very profitably, and still contains many places which have never been worked. It was exceedingly rich in some places. Mr. Tate informs me he once, with five hands, made 50 dwts. by 11 o'clock in the forenoon. It generally averaged several dwts. per hand. Says that several thousand dwts. have been taken from it of which he has received toll.

The Caleb's Branch was once the most celebrated deposit in this section of the country, having given rise to the Muddy Creek Gold Mining Company, which employed at first eight hands, averaging per hand 25 dwts. per day for six months. After that time the force was increased to thirty hands, who averaged, with three rockers, 100 dwts. per day for twelve months. The Company refused the offer of $5,000 for the privilege of working twenty-five hands fifty days.

There is no doubt that these deposits would pay well a second working over, as is known to be the case in countries where long years of experience in deposit-mining has proved. In the Russian gold and platinum deposits upon the Siberian flank of the Ural Mountains, where this branch of mining, previous to the discovery of gold in California and Australia, had been prosecuted so extensively and brought to the greatest perfection, the old deposits are worked repeatedly after a lapse of a few years.

FORMER WORKINGS.

The Tunnel Vein was opened some ten or eleven years since by Mr. Thomas J. Forney, who sank two shafts upon it, one of them to the depth of 75 feet, and drove in three adits from the north declivity of the Tate Branch. One of them is about 150

feet long before it reaches the vein, and attains a depth of 80 feet without finding water. The vein, to some extent, has been worked both ways from this by galleries. The ores with the vein rock were heaped up in large hills on wood, and partially roasted so as to be easily crushed. A stamping-mill, running nine stamps, was erected on the Meadow Branch to crush the ores, which still stands there with all the stamps. The shaft of the wheel is as round as ever, *and with some repairs on the wheel is ready for service.* Owing to the injudicious management of having stamped up the iron and copper pyrites with the sulphuret of lead, which, becoming partially reduced to metallic lead by the roasting, the consequence was, that the mercury became "floured" and passed off, carrying with it all the gold it had taken up, while the remainder became so blackened and loaded with lead that it could take up but a small portion of the remaining gold, and at the same time the gold of the brown ore, or oxide of iron, derived from the decomposition of the iron pyrites, being very fine, was carried off by the water from the stamps. The consequence was, the work was abandoned.

QUANTITY OF ORE.

Of the absolute quantity of ore in the vein, I am unable to speak from personal observation, because all access to the vein was denied me from the timbering of the galleries having rotted down and suffered them to become filled up. My only chance, therefore, was that derived from the refuse thrown aside near the places where the roasting had been performed. From this, too, the best had been barrelled up and sent off for samples. The remainder, however, offered very flattering indications, and sustains, as far as it goes, the statements of others concerning this point. One fine feature was the decided tendency of the ores to occur *in seams* and not in isolated blotches or nests, *the lead and copper occurring together in one seam, and the iron pyrites in another and distinct one.* But from reliable statements derived from others, who have worked in this mine, the quantity *is very large.* According to Mr. Forney, the vein at its greatest depth maintains an average width of from 18 to 20 inches, one half of which, or 9 inches, would be ore, and of this from 4 to 5 inches be galena or the sulphuret of lead; and of the other half, or from 4 to 5 inches, from one to two inches is the sulphuret of copper or copper pyrites, the remainder being iron pyrites.

Mr. Morrow, who worked in the adits and shafts several months, also asserts that the ore, if it were all in one body, would be more than half a foot thick at the greatest depth attained by the shaft and adits—that it increases very rapidly in descending—that it occurs in layers or seams, the lead and copper generally together—that the copper would form a seam about two inches wide—that there is as much lead as iron—that

the brown ore, very rich in gold, occurs, to the best of his recollection, on the lower side of the vein, and is perhaps 2½ inches thick—that the working *nowhere reached water*—that the vein is underlaid by a seam of the white porcelain clay about a foot thick—that the ore lying near the places where roasted is refuse thrown away for containing too much veinstone—that the work was dropped on account of the great quantity of lead, which loaded and blackened the mercury so that it collected no gold.

Mr. Justiss says he worked in the vein—that the ore would form a seam more than half a foot thick—that the lead ore would be several inches thick—that the rest was sulphur, the name by which pyrites are here known, of which large quantities were *yellow or brass-colored*—that no water of any consequence was met with in any of the workings—that the slates *were all rotten*, and in driving in the upper tunnel, he advanced generally 10 feet per day—that the ore lying around the tunnels was refuse, and not considered worth stamping—that he worked in the vein six months, took Morrow's place, who went to work the stamping mill.

VALUE OF THE ORES.

Galena.—From an average of five assays, by the "dry way," of this ore from the Tunnel Vein, save a part which composed one assay made up partly from some from the Tulip-tree Vein, I obtained 81.25 per cent. of lead, and at the rate of 89.44 oz. of silver to the ton of ore, which, at the rate of $1.29 per oz., equals $115.37 per ton. Taking the ordinary value of pure galena as $45 for the lead, the value of a ton of this ore would be $160.

Gold.—The gold obtained from the iron pyrites of this mine is highly alloyed with silver, averaging generally 66⅔ per cent. of gold and 33⅓ per cent. of silver; or, in other words, is two-thirds gold and one-third silver. The proportion in the copper ore is not so constant, the proportion of silver being generally much greater, as might be expected from the greater affinity of these metals. The coarse gold of the deposits was also highly alloyed with silver, and sold at from 75 cts. to 82 cts. per dwt. From the average of ten assays by amalgamation of all the kinds of ore from these veins, assuming it to be worth 75 cts. per dwt., the result was $60 per ton. The highest result obtained, but not included in the above average, was from some very cellular quartz, containing much decomposed matter, from the interior of a large block in which so much native sulphur was found, yielded me at the rate of $393.85 per ton of pure gold, at $1 per dwt.; silver at the rate of $14.71 per ton; in all, $408.56 per ton.

Copper.—From an average of two assays, by the dry way, of copper pyrites, free from quartz, I obtained 33.50 per cent. of copper, silver to the value of $125.06, and gold to the value of

$210.77 per ton—equal to $335.83, exclusive of the value of the copper, which, at ordinary prices of that ore, would make a ton of it possess a value of at least $500.

In view of the large proportion of silver alloyed with the gold, together with the large percentage of it in the galena, the inference would be by no means slightly founded that the discovery at greater depths of silver glance, or the sulphuret of silver (one of its richest ores, yielding 85 per cent. of silver), might be looked for.

The quantity and quality of the ores of this mine therefore merit a better mode of treatment than the one formerly tried with them. The great amount of lead, which was the former obstacle, need not, at this time, afford any; while, at the same time, however, the great amount of silver in the lead is of itself, aside from the gold and copper, were these entirely neglected, a sufficient inducement for this. In working these ores for gold alone, or for both gold and silver, etc., a simple and indispensable operation, entirely neglected in former workings, will almost entirely obviate the difficulty, at least as far as any interference of the lead with the mercury is concerned. This is "cobing," or a rapid separation by hand of the different kinds of ore as soon as raised from the mine, which, in the mining districts of Europe, is performed by boys. The ores, with the vein-rock adhering, as it comes away from the mines in large blocks after blasting, are broken to pieces coarsely and freed from the matrix by hammers, and each kind thrown to a pile by itself. This simple and cheap process is invariably pursued there, which in cost, compared with the cost of stamping and smelting so much foreign matter, is comparatively nothing. In working these ores solely for gold, the iron pyrites occurring mostly in seams need only thus be cared for, together with the cellular and richer portions of the quartz. By performing this work the way is also commenced for completely and separately separating the three sulphurets composing the ores one from another. By a recent invention of Mr. Bradford, of New York, a very cheap and practical separator has been constructed, which will prove of the highest importance in the separation of ores, doing away with "jigging," "chissoming," "racking," and other cumbrous machines now in use for this purpose. By this, the galena can be completely separated from the copper, as well as each of these from all sand or quartz; and if any lead should still be among the iron pyrites destined for amalgamation, every trace can be thus separated. This can be accomplished at a very trifling expense, and at a rapid rate, one machine separating three tons per day, requiring only one hand to several machines.

But there is another circumstance worthy of remark in passing, before dismissing this subject relative to the ores. It is a well established fact, by those who have had long experience in

the extraction of gold, as has been the case in Hungary and Transylvania, that but a small proportion of the gold can be obtained by amalgamation, even by the most careful roasting, when compared with the amount obtained by the modes now in use. You have here all the requisites for carrying this out. The rich argentiferous lead requires to be melted. For this, as is well known, in order to form the necessary slag, iron pyrites, silex, or quartz, and a little lime only are requisite. Now, the iron pyrites here contain a large per centage of gold and silver, the brown ore and cellular quartz contain gold also and the silex, while the lime is easily obtained. Now the lead, during the process of fusion, will take up all the gold and silver from the iron and quartz, and concentrate it with its own silver, forming an alloy of gold and silver of, at least, double its original amount. The process is nothing more than the German process of lead smelting, and is attended with very little expense. The furnaces require for their construction nothing more than rock to be obtained near at hand, as I have seen them in the extensive government works at Freyberg, in Saxony, built of gneiss, and the tin furnaces of Altenberg and Zinnwold, of granite. Another feature in the economy of the process is the employment of charcoal for fuel, obtained at a trifling expense. The point near the union of the Tate and Meadow branches, near the present stamping mill, presents an admirable site for such a purpose, with ample water-power; while a tramway, constructed along the Tate branch, could bring down the ores from all the veins on both sides of it.*

In conclusion, I may be permitted to say that, in view of the many advantages concentrated upon this property—its great extent—the number of its veins—their richness in gold and silver

* With respect to the modes of working these ores as here suggested, Prof. B. Silliman, jun., says, in a brief note which has come to hand:—"I entirely agree with Mr. Ellery (taking the facts to be as he states them) in regard to the mode of treating the ores of the Catawba tract. If managed with economy and scientific skill, successful results may be confidently anticipated. I am happy in having an opportunity to testify my confidence in Mr. E. and his Report on the Catawba tract." The entire note of Prof. S. is very complimentary to Mr. E.; and, although not strictly a part of the subject before us, we are tempted to insert it in this place as a tribute to merit. He says:—"I have read Mr. E.'s Report, and also seen the specimens of argentiferous galena and gold quartz. Mr. E. is favorably known to me. He was, for two years, at the Government Mining School, in Freyberg (Saxony). He was there during my visit to that place in 1851, and returned to this country in 1853, with the honors of that institution. He has since visited me at New Haven. I am disposed to place much confidence in his statements, both as a man of veracity and of very competent scientific skill as an observer in the department which he has chosen as his profession. I know but two or three other young men in the United States who, in my judgment, have enjoyed advantages equal to those of Mr. E. in this special and difficult branch of business. His Report is lucid, direct, and bears intrinsic evidence of a thorough acquaintance of that whereof he affirms."

—the great facility for working them—and the fine water-power, with the prospect of such available means of transport by a railroad close at hand, it bids fair, when developed, of finding few rivals in this country.

Art. III.—TESTS OF IRON.

The new Swedish iron test is known as belonging to the best on the dry way. Upon this subject, the third volume of Tunner's Annual for 1853 contains some highly instructive remarks, which we recommend to the especial attention of iron-workers among our readers.

It is important that the iron-worker should be possessed of a very easy analytical process for the testing of iron ore and metallic iron. Therefore, the processes called "Volumanalysis," so distinguished for the facility of its accomplishment, by means of which we ascertain the quantity of a specified body out of the exhausted volume of a normal solution of known concentration, continue to be more and more adopted. But to render such a test practicable and very useful, the required normal solution should be easily prepared; and, once prepared, remain a long time in a condition fit for use. Bichromate of potash perfectly fulfils these requirements. Schabus, in Vienna (Berg— & hüttenmännische Zeitung, 1852, No. 46), has applied this substance with advantage to the iron test, and thereby avails himself of the following process. The common analytical method of dissolving iron ore by means of an acid, and then precipitating it as an oxide, is, on account of the many ingredients which iron ores and also frequently the chemical products contain, very inconvenient, and requires, in consequence of the many precautionary measures to be applied, a certain practical skilfulness on the part of the operator. But the most general method of ascertaining the intrinsic worth of iron ore, viz., that of the dry way—valuable as the results thereby obtained may be to the iron-worker—presupposes a scientific and habitual expertness, besides an oven in which a high temperature may be produced, yet it never furnishes the quantity of pure iron. Hence, this test cannot be applied by every one. The method adopted by Margueritte, on account of its simplicity and facility of accomplishment, deserves, therefore, to be generally introduced. The principle upon which it is founded rests on the fact that the protoxide of iron, by certain means of oxidation, becomes converted into oxide of iron. But as a means of oxidation, he makes use of hypermanganesiate of potash, and distinguishes the point at which the protoxide becomes transformed to oxide, by the appearance of a pale pink

color, which shows itself when the operation is concluded. But as, however, it is difficult to preserve this salt in crystals, it is necessary, in order to give its solution the required alloy of this salt, to undertake a test with a certain quantity of iron wire dissolved in hydrochloric acid to chloride, which is attended with the embarrassment, that an error thereby committed, which might proceed from a greater or less quantity of foreign ingredients contained in the wire, transmits itself to all the tests to be undertaken with it. Another difficulty consists in the fact that the hypermanganesiate of potash decomposes when left to stand, the contents of the solution, after a short period, becoming changed; therefore, before each test, which is undertaken some time after the preparation of the normal solution is accomplished, a rectification of it should be repeated. Many who are less familiar with chemical works also find difficulty in the preparation of the hypermanganesiate of potash. Mr. Schabus sougnt to replace the same with another salt, by which the desired transformation of the protoxide into oxide of iron was effected without possessing the disagreeable qualities of the *manganesiate*. Bichromate of potash is indeed excellently adapted to this purpose. Therefore, in order to obtain a correctly prepared normal solution, but one equivalent of this salt is required, and, indeed, the weight to be expressed in decigrammes; 14·77 grammes to be weighed and dissolved in so much water as to obtain a *liter* normal solution. The requisite bichromate of potash is obtained simply by recrystallizing the salt usual in commerce. By means of this normal liquid, after the correct quantity of the body to be examined has been dissolved according to one of the undermentioned methods, and any existing oxide of iron has been reduced to protoxide, the test may thereby be accomplished by adding so much of the solution of bichromate of potash as is contained in a measuring tube holding 100 cubic centimeters, and divided off in at least semi-cubic centimeters, filled up to the null-mark, to the iron solution, until all the protoxide becomes transformed into oxide. As only the solution of the protoxide—but not that of the oxide — produces, in connection with prussiate of potash (ferro-cyanide of potassium), a blue precipitate, the point at which a perfect transformation is accomplished may be easily ascertained by the help of this combination. To this end, sprinkle a piece of porcelain with a few drops of prussiate of potash, and bring, after each addition of the normal fluid to the iron solution, and a perfect stirring of the same by means of a glass stick, some of the fluid in connection with one of these drops; as long as a blue coloring of the same takes place, continue to add the normal fluid; when the coloring ceases, the operation is completed, and the number of exhausted cubic centimeters of the normal fluid show, according to the quantity of the body employed in the test, the per centage of iron. As the chromic-

acid of bi-chromate of potash becomes reduced by means of chloride of iron to oxide of chrome, and this becoming detached from the superfluous hydrochloric acid, the fluid assumes a green color. This circumstance materially facilitates the operation; for as long as the pinkish color of the testing fluid whilst poured into the iron solution changes quickly to the green of chloride of chrome, the test with the prussiate of potash need not be made. If this take place but slowly, great caution is needed when pouring in the latter, and after each addition it should undergo the given proof. In many cases it would be time saving to fix at the first test the alloy of iron at two per cent.—further exactness to be ascertained by a second test. If great precaution be observed, particularly when proceeding to the end of the operation, the result obtained by this method, if the division of the measuring cylinder be sufficiently exact, may approach from 0·2 to 0·1 per cent. of the real value. By this test, as may be seen from the foregoing, the quantity of protoxide contained in the solution will only be ascertained. But iron may be found in another form in the combination; wherefore the three following cases should be distinguished:—first, that iron is either contained as a metal, or as a protoxide, in the combination to be investigated; secondly, besides protoxide, oxide also may be found; and, thirdly, all iron is contained in the combination as an oxide. In the first case, there is nothing further to be done than to dissolve the iron by hydrochloric acid, or to bring the protoxide in solution, and perform the test after the method described, in order to ascertain the full quantity of iron contained in the combination to be investigated. In the second case it is only required to know: *a*) the total quantity of iron contained in the combination; in which case, the existing oxide is to be reduced to protoxide, in the manner presently to be given, and with this protoxide solution the test is to be undertaken; or, it is desirable: *b*) to know how much of the existing iron is contained as protoxide, and how much as oxide. To ascertain both these quantities, it is necessary, besides the test given under, to make a second test, without, however, previously reducing the oxide. The number of cubic centimeters of the normal fluid exhausted by this second test shows the per cent. of iron which exists in the combination as protoxide. If these be deducted from the total quantity of iron, the balance will show the per cent. of oxide. In the third case, the oxide must, previous to the test, be reduced to protoxide. To this end metallic zinc is preferable, which, however, must be free of iron. After a *a*) solution, containing much free hydrochloric acid, of the body to be examined, has been prepared, the zinc, in a thin sheet form, must be submerged into it. The oxide of iron will be reduced to protoxide, and thereby the solution made colorless if there be no other coloring combinations contained in it. Copper and arsenic are abstracted

in metallic form, and can, after the completed reduction, be separated with the yet undissolved zinc from the solution of chloride of iron by filtration. Is the substance to be examined soluble in water? hydrochloric acid, or sulphuric acid, which dare contain, however, neither nitric acid, chloride, iodine, bromide, sulphurous acid, nor iron, must be added to the watery solution before the commencement of the test. Bodies not soluble in water may be dissolved in concentrated hydrochloric acid, or, when necessary, with an addition of nitric acid. It is hardly necessary to mention that, in this latter case, to detect the quantity of protoxide, where oxide of iron exists, is impossible. Bodies which admit of being pulverized, should be used in powdered form, and cast iron in the shape of filings.

To ascertain directly, from the number of cubic centimeters employed for oxidation of the testing fluid prepared according to the above-given directions, the quantity of pure iron contained in the test to be investigated, there must each time be taken, 1·68 grammes of the test in work.

In many cases it would appear, however, desirable to know how many per cent. exists in that combination of which iron forms a constituent part. The combinations most generally submitted to examinations are (*a*) spathose iron (carbonate of iron); (*b*) magnet ironstone (*Eisen oxyduloxid*); (*c*) ironglance, red hematite of iron, *blutstein* (oxide of iron); (*d*) brown hematite of iron, *pyrosiderit, eisenrost, stilpnosiderit, sumpferz raseneisenstein, etc.* (hydrated oxide of iron); (*e*) iron vitriol (sulphate of iron).

The quantity of carbonate and sulphate of iron, oxide of iron, etc., can be ascertained by weighing off for the test a quantity of the body to be examined suitable to the equivalents of the combination sought for.

This amounts to for the—

	Grammes.
Carbonate of iron	3·48
Protoxide of iron	2·32
Oxide of iron	2·40
Hydrated oxide of iron	2·67
Sulphate of iron	8·34

By reviewing that which has been said in the foregoing, it will be perceived that, by this test, the whole process, as the normal fluid admits of being prepared and preserved in larger quantities, may properly be reduced to the three following operations:—first, the dissolving of the body to be examined; secondly, the reduction of the solutions containing oxide of iron, through zinc, whereby both copper and arsenic are at once absented; and, thirdly, a cautious pouring of the bichromate of potash to the solutions of protoxide, until a drop of the same, in connection with prussiate of potash, no longer produces a blue precipitate, and a summing up of the exhausted cubic centimeters of the normal solution.

Art. IV.—MINES AND MINING OPERATIONS IN CHILI, SOUTH AMERICA.

THE Republic of Chili, on the Pacific coast of South America, is divided into a small number of provinces, each of which is governed by an Intendant, who is appointed every three years by the President and Council. Each province is likewise divided into one or more departments, having its municipal body, etc., etc. The Intendant of each province makes a report to the Minister of the Interior of the condition of that province or portion of the republic intrusted to his supervision. These reports are designed to contain accounts of everything of a public and industrial nature in the province.

Atacama is one of the most important provinces of the republic. It embraces the rich mining district of Copiapo, which contains mines worked for gold, silver, and copper. On the 7th of July, 1852, Señor Antonio de la Fuente was appointed Intendant of this province, and at an early moment entered upon the duties of his office. "My administration," he says, "began at a gloomy period (una epoca bien triste); on every side were visible the deplorable results of our political distractions." Soon after the close of the first year, in October, 1853, he had prepared and submitted to the general government a very careful, complete, and able report of the state of the province in all its civil and industrial relations. This report, a copy of which has been very kindly forwarded to us, furnishes the most complete and accurate account of the extensive and rich mineral districts of the province. Although our attention may be devoted more exclusively to this portion of its contents, we cannot, in this instance, withhold a passing notice of one or two subjects of general interest to the public which present themselves in looking over its pages.

The province of Atacama is composed of the departments of Copiapo, Vallenar, and Freirina, the population of which is respectively 40,000, 15,000, and 10,000—total, 60,000. In the department of Copiapo, a railroad, fifty miles in length, has been in operation since December, 1851. It connects the city with the port of Caldera, which is one of the best harbors on the Pacific. The cost of construction was $2,380,795, which includes station-houses, engine-houses, etc. It is furnished with ten locomotives, eight first-class, five second-class, and about a hundred baggage cars. "This bold enterprise originated in the speculative genius of the inhabitants of Copiapo. It is the most important element," says the Intendant, "of all material and intellectual progress." The receipts of the road from January, 1852, to the close of August, 1853, were $526,864. The fare is $4 and $2 in the first and second class of cars for the whole distance. The

road is about to be extended, and branches added. The public hospitals, the religion, the establishments for education, courts of justice, public prisons, criminals, population, police, public health, military, finances, imports and exports of the province, are described with great clearness and ability. This is particularly the case with the mining operations, which are described with much fullness, in order that the supreme government may have a complete idea of their importance, embracing the condition both of the mines which are worked and of those which are abandoned.

MINES OF GOLD IN THE DEPARTMENT OF VALLENAR.

Zapallo, situated five leagues south of Vallenar, contains several rich mines, which are now abandoned, and some veins of quicksilver, of which little is known. It has a plenty of water, wood, and pasturage, and a railway runs through it.

Minillus e Higuera is eight leagues south of Vallenar. It is now entirely abandoned. Its mines have been rich, although the veins are small. It contains plenty of water, wood, and pasturage; and, in the ravines, gold is found by washing.

Pasto-Largo, thirteen leagues south of Vallenar, contains very large and metalliferous veins, now entirely abandoned, with water, wood, and pasturage, and some veins of good copper ore. The refuse contains large quantities of metal, which could be worked with great profit by machinery.

Magdalena.—This place is about seven leagues south of Vallenar, and although abandoned, it has good mines. It has excellent water, and an unfailing supply of wood and pasturage.

Caldera.—The mines are abandoned. They have been very rich. It is situated twenty leagues from Vallenar, south of the river Carmen, and contains wood, water, and pasturage. In the plains is found gold in small quantities but of superior purity; also a kind of small potatoes, the plant of which is not seen, but is discovered at a depth below the soil; its flavor is like that of radish. The road is tolerable.

Huachacan was discovered in 1819, by Lorenzo and Juan A. Torres, and has been abandoned for four years. It abounds in pasturage and wood. The road is bad.

Laguna, twenty-three leagues east of Vallenar, in the range of mountains called "Del Medio," contains a number of abandoned mines, and only that called Milagro is worked. There is a plenty of wood, and some pasturage; and a stream of water flows from a height above the mines, falling more than four hundred feet, forming the beautiful cascade of Huanchicai.

El Medio, in the mountains known as the Middle Range, is twenty leagues from Vallenar, contains many mines now abandoned, among which *Paculito* produced so much gold, that, according to tradition, it was weighed with scales. Wood, water,

and pasturage abound, but nothing more is yielded at the present day than the little gold which some laborers find by washing the debris from the mountains in the little stream which flows at their base.

Juanillo.—The mines are old and abandoned. They are likewise in the Middle Range, and sixteen leagues from Vallenar. The place has been metalliferous, and is supplied with wood, etc., but the road is bad, like all others in Upper Huasco.

Santa Catalina has been abandoned from time immemorial. It lies seven leagues north of Vallenar, in a mountain range of such remarkable elevation that it is the first object seen by the mariner about to enter the port of Huasco. It abounds in wood, etc., and half the way is a carriage road.

Munambilar is entirely abandoned. There is no question of its richness and abundance of ore. It is situated fourteen leagues north of Vallenar, with wood, water, and pasturage most abundant, but the road is bad.

Molles has been worked but little. It is twenty-two leagues from Vallenar, north of the river Transit. Wood and pasturage abundant, and water sufficient.

Bajo Petacas is utterly forsaken. It is thirteen leagues north of Vallenar, has been good, and contains wood, etc.

Jote, Jote Nuevo, Andacollo, Santa Jertrudis i Corrioncitos.—These places comprise a large extent of country, and are situated about sixteen leagues north of Vallenar. They contain a large number of mines, many of which have been productive, especially the one called "Estevan Torres," the vein of which can be traced on the surface for more than a league. Wood, water, and pasturage are abundant, and some mines of silver, copper, and lead are met with.

SILVER MINES IN THE DEPARTMENT OF VALLENAR.

Agua-Amarga.—This rich and celebrated mineral tract was discovered in October, 1811, by Jose Paco-Hicuime. It is situated about eight leagues south of Vallenar, on a good bridle road, which can easily be converted into a carriage road. It is uniformly supplied with wood and pasturage, and contains six watering places. The discoverer, better known under the name of Chamblao, found the vein called by the name of "Portezuelo de Zuleta." It contains more than one hundred and fifty mines which are opened, although those only are worked which are known by the names of *Caldera, Aris, Monto de Astorga, Monto del Transito, Mieres, Espejo, Filiberta, Ignacio, Veliz, Manto de Guerra,* and *Socabon.* The character of the rock until a certain depth is calida,* or virgin silver and lead ore; but at a greater depth the mineral is combined with lead and arsenic. This

* *Calida* is the term applied to ores which can be amalgamated.

isolated range runs in a direction about north and south, and is two leagues of longitude to one of latitude. Its ore is as good as the best at Copiapo, and it extends down the sides of a ravine without change, whence it is inferred that its depth is immense. The temperature of the climate is uniform, and very healthy: in summer, the west wind cools it, and in winter, the elevation of the earth is such as to prevent the fogs which cover the plains. The deepest mine in Caldera is one hundred and fifty fathoms.

The ore of Agua-Amarga has, without doubt, been the most celebrated in all Chili since its discovery, for the substantial aid which it contributed towards the independence of the country. The public treasury received immense sums in dollars.

Viscachas.—The mines of this tract were discovered in 1811 by Jermon Torres. They are limited in number, but very rich. Actually abandoned, although having wood, water, and pasturage, they are fourteen leagues south of Vallenar. The discoverer of the mine met with a crest of silver, which projected from the ground for a considerable space. Pieces have at times been found, on digging in various places in the ravine.

Algarrobo.—Discovered in 1812, by J. Torres and M. Lerma, nine leagues south of Vallenar. It contains many mines, which have been as rich as those of Agua-Amarga. It abounds in wood, water, and pasturage, and is at this day totally abandoned. The road thither is good.

Tunas.—This rich and extensive mineral tract was discovered in 1811, by the brothers Jose and John Espinoza, at sixteen leagues south of Vallenar. Having plenty of wood, etc., its mines are as rich as those of Agua-Amarga, and the veins larger, which, at a greater depth, produce virgin, arsenical, and red silver ore. Only four mines are at present worked: that which is known by the name of "*Urizar*" is rich and profitable; the rest pay expenses.

Barrancones.—This tract, eighteen leagues south of Vallenar, is abandoned. There is no lack of water, etc., and the few mines it contains have been very good.

Cañas was discovered in 1817, by D. Manuel Meri, fourteen leagues south of Vallenar, and is little known. At present, only a few of its veins are worked.

La Plata is fourteen leagues south of Vallenar, with sufficient wood, etc. The few mines it contains are abandoned.

Cortadera is ten leagues south of Vallenar, with a uniform road, and plenty of pasturage, etc. It was discovered in 1801, by N. Mancillo and Jose A. Castro. Its mines have been very rich, although they are at present abandoned, with the exception of the vein called "Moreno," which yields arsenical and red ore.

Carrizo de la Sierra was discovered in 1816. It is situated seven leagues south of Vallenar, and is abandoned, excepting

three mines, one of which is profitable. The mineral tract is rich, like that of Agua-Amarga, and contains wood, etc.

Almireces.—An old and extensive mineral tract, twenty leagues south of Vallenar. It contains wood, water, and pasturage, and mines both of gold and copper. The character of the ore is silver and copper, although at times there is considerable lead. Only a few mines of copper are worked.

Carrizo.—Situated south of the river Carmen, and twenty-two leagues from Vallenar. In the neighborhood are the mineral tracts of *Breas, Molles, Higuerita, Mina Vieja,* and *Burro Muerto,* all very ancient, and well worked, although at only the last is anything now done, where a furnace is established. These tracts are interesting from the splendor of the veins, the ore of which is copper, having at times considerable silver, and also from the contiguity of the valley, whence cheap provisions and constant labor can be obtained.

Hornos is abandoned. It lies south of the river Carmen, and eighteen leagues from Vallenar, and has sufficient wood, etc.

Chingales has been deserted from time immemorial. It is situated south of the river Carmen, and thirty leagues from Vallenar. Its mines are of good depth. It contains wood, etc.

Francisco Dias i Mollaca.—This tract is little known. It is five leagues north of Vallenar. The four veins discovered have been rich in virgin silver and lead. It contains wood and pasturage, and but little water.

Cortadera i Llico, at twelve leagues to the north of Vallenar; it has mines that were very rich in argentiferous lead. It contains sufficient wood, etc., and has a good road.

Carrizo, San Ildefonso i Matancilla.—These important mineral places, in former times, are deserted. They are seventeen leagues north of Vallenar, and contain an abundance of wood, etc.

Los Barras is north of the river Transit, and twenty-two leagues from Vallenar. It is nearly abandoned; only one mine is worked which is profitable. The character of the ore is argentiferous galena.

Amolanos.—Discovered in 1835. It is situated north of the river Transit and twenty-two leagues from Vallenar, and has an abundance of wood, water, and pasturage. Its ores are virgin silver and lead. Lumps of native copper joined to others of silver are common. The tract, abandoned at first, is now little known. At the present time, only one mine is worked, the richness of which is much spoken of. Its contiguity to the river is a convenience.

Calpe.—Discovered in 1825. It is north of the river Transit, and twenty-five leagues from Vallenar. It is extensive, and little known; the character of its ore is silver and lead. It contains wood, etc., and cheap provisions.

COPPER.

Ojos de agua, Totora, Cruz de caña, Algarrabito i Cachivito—districts lying south and at a little distance from Vallenar. They are supplied with wood, etc., and the ores are of good quality. Only one or two mines are worked.

Camarones is a rich and extensive tract, five leagues south of Vallenar. It contains many mines, at present worked, of which "Marquesa" is the most extensive, where smelting furnaces are established. The ore is abundant, and of good quality. It has sufficient water, etc., and some mines of gold, of which little is known.

Alcaparra, Cristales, Cobre i San Antonio—mineral tracts south of Vallenar, supplied with water, etc., where a great number of mines are worked to well-known advantage; above all those of the last tract, which is very rich and extensive, and distant nineteen leagues from Vallenar.

Orito, Jarilla, Tola i Cortadera.—These are situated south of the river Carmen, and eighteen leagues from Vallenar. They contain many mines, the most of which are forsaken. Those which are worked are profitable, and their ores contain more or less of silver. In the ravines of the hills of Orito, gold has been discovered by washing, which has yielded a profit in the rainy season, some pieces being found of several pennyweights. Wood, water, and pasturage abound.

Jilguerro, Potrerillo i Remolinos, are situated three leagues from Vallenar, on a good road, with an abundance of water, etc. The number of mines is large, and the ore of good quality, deriving many advantages from contiguity to the valley and the canal of "Maranon." Only a few of the mines are, however, worked.

Piedra parada is but little known. Its ores are good, and generally contain silver. It is five leagues north of Vallenar, on a good road, with an abundance of wood, some pasturage, and water. A few mines are worked.

Chehueque, Calaberas, Mollaca i Ramadas, are four and seven leagues north of Vallenar, with good roads, and plenty of water, etc. They contain alternately ores of gold, silver, copper, and lead; although, at the present day, only some mines of the two last minerals are worked.

San Antonio, Maricunaga i el Toro.—These tracts, provided with wood, etc., are about fourteen leagues north of Vallenar; and although the mines are few, the ore is good. At present, they work only that called "San Antonio."

Jarilla i Dolores is eighteen leagues north of Vallenar, with plenty of wood, etc. Its mines, next to those of "Camarones," are the most productive at the present day. Its ores are of superior quality; nevertheless, many of its mines are at present abandoned.

Relincho, Ratoneo i Pircas.—These extensive mineral tracts, supplied with water, etc., and the ores so rich as to yield sixty per cent., are north of the river Transit, and twenty leagues from Vallenar. At present, only a few of the mines are opened.

Tubaco, situated north of the river Transit, twenty leagues from Vallenar. It has abundant pasturage, etc., and its ores are quite rich, containing a quantity of silver. Only a few of its mines are now worked.

GOLD MINES IN THE DEPARTMENT OF FREIRINA.

Capote is north and nine leagues from Freirina. It is the first in the department, and appears entirely abandoned; although a company intended to work there, it has encountered difficulties insurmountable. The road thither is for the most part bad.

Canutillo has been rich, although now forsaken. It is five leagues south of Freirina, on a good road. Its principal mine, called "Socabon," is not deep.

San Fernando, a little more to the south than the preceding; it is no less rich. It is, however, abandoned.

SILVER MINES OF FREIRINA.

Cardon is the only locality for silver known in the department of Freirina. It is recently discovered, and its ores are by turns silver and copper; and although it is believed it will prove rich in depth, judging by the external indications, yet it was unnecessarily almost entirely abandoned upon the failure of the surface yield.

COPPER MINES OF FREIRINA.

Carrizal.—This is the most important in the department for the abundance and excellence of its ores. It is seventeen leagues north of the valley, and has many inhabitants. The road is in good order.

San Juan, Rosario i Labrar, are situated in the southern part of the valley, and are distant from Freirina, the first, eight, the second, ten, and the third, eleven leagues. San Juan, which is the most extensive, and has been the richest, is more than three-fourths abandoned, through want of capital and force to work its mines. The other two are more populous, and in an organized state. The roads are all good.

Morado.—This extensive mineral tract is south of the valley, and eighteen leagues from Freirina. In its vicinity are various other tracts, as *Pelícano, Altar,* and *Mollaca,* all of which are sparsely peopled, from the same causes which affected *San Juan;* and, without question, they contain a large number of valuable mines. *Morado* is in an organized state. The road there is mostly bad.

Arenillas, Espejuelos i Rincon, are three or four leagues from

Freirina, and sparsely populated, particularly the first. The other two are regularly organized. The roads are good.

Leoncito, Carricito, Carrizalillo, Caminada i Santa Cruz; all these are in the neighborhood of Freirina, and although of limited extent, have contained mines very rich in quality, and abundance of ore. They are now almost completely forsaken, from the same causes which have affected the preceding.

FORMER PRODUCT OF THE OLD MINES.

The product of the mines of Vallenar has been in former periods marvellous, and it is surprising that there is now so little capital applied to their development, and such a want of science on the part of the miners, as well as profit from the ores.

Four mines of gold, from the date of their discovery until 1843, yielded $1,009,024; twenty-two mines of silver yielded $2,869,020; and forty-three of copper yielded 388,024 quintals of that ore, equivalent in value to $5,432,336—total, $9,310,380.

NEW VEINS DISCOVERED, AND OLD MINES REOPENED.

The greatest proof of the activity of the mining population of the province of Atacuma is found in the number of concessions of new and old veins made by the authorities.

From the 1st of January, 1851, until the 31st December, 1852, in Copiapo, and until the 30th April, 1853, in Vallenar and Freirina, there were discovered 1,826 veins of gold, silver, and copper; some in the sierras had been formerly known—others were entirely new. Of this number, 29 were gold, 1,177 silver, and 621 copper.

Of these, there were, at Copiapo, 27 gold, 1,079 silver, and 496 copper; at Vallenar, 2, 86, and 63; at Freirina, 12 silver and 42 copper.

With regard to the mines, which laid entirely abandoned, and which have been conceded during the same time to new managers, the number is 986, of which there are at Copiapo 761, to wit:—gold 12, silver 565, copper 184; at Vallenar, 135, to wit:—gold 4, silver 75, copper 56; and at Freirina, 1 gold, 7 silver, and 82 copper.

Notwithstanding the surprising number of old mines reopened, there are still immense mineral deposits totally abandoned. Supposing, however, there was no field for new discoveries—which is by no means true—the working of the forsaken veins would afford employment to thousands of hands and millions of capital, and would increase public and private wealth an hundred fold.

MINES IN OPERATION.

	Gold.	Silver.	Copper.	Total.	Miners.
Copiapo,	17	509	116	642	6,869
Vallenar,	3	25	60	88	440
Freirina,	2	2	90	94	855
Total,	22	536	266	824	8,164

The principal silver (minerales) tracts of Copiapo are *Chanarcillo*, *Tres Puntas*, *Romero*, *Perez*, *Sacramento*, and *Lomas Bayas*. The chief mines of each are the following:—Of the first, *Descubridora*, *Colorada*, *Delirio i San Francisco*; of the second, *Buena Esperanza*, *Salvadora i Alfin Hallada*; of the third, *Retamo i Presidenta*; of the fourth, *Clorinda*; of the fifth, *Cobriza i San Jose del Rosario*; and of the sixth, *Descubridora*. The following table presents some particulars of each:—

Mine.	Fathoms depth.	Miners.
Descubridora,	150	303
Colorada,	140	176
Delirio,	90	77
San Francisco,	50	103
Buena Esperanza,	32	141
Salvadora,	120	128
Alfin Hallada,	85	135
Retamo,	—	23
Presidentia,	—	34
Clorinda,	30	57
Cobriza,	30	43
Rosario,	88	24
Descubridora,	—	27

These mineral resources impart life and activity to the department of Copiapo, and are the source of its principal prosperity. There are other mountain tracts where a considerable number of mines of the same ore are worked, but time alone can determine their future importance.

Mining enterprise there would never have advanced to such a height, if the spirit of association or combination had not extended to all the inhabitants of Atacuma. At present, there is scarcely a mine which is not worked by a distinct Company, whose capital and intelligence is contributed to most arduous enterprises, such as would have swallowed up the means of a single individual, however bold and enterprising.

PRODUCT OF SILVER AND COPPER.

According to the records of the Custom Houses* at Caldera and Huasco, there has been exported as follows:—

	1851.	
Silver bars—marcs,	363,415	$3,543,296
Silver ore—quintals,	60,216	903,240
Copper ingots, "	6,871	109,936
Mineral cake, "	74,815	610,425
Crude ore, "	87,824	219,560
Total,		$5,386,459

* The Custom House returns are founded on the amount rendered for export duty. Probably one-third to one-half should be added for the amount which escaped the export duty.

1852.

Silver bars—marcs,	407,424	$3,972,354
" ore—quintals,	106,445	1,596,675
Copper ingots, "	10,379	166,064
Mineral cake, "	58,449	496,816
" ore, "	118,580	296,450
Total,		$6,528,360

FIRST THIRD OF 1853.

Silver bars—marcs,	122,418	$1,193,575
" ore—quintals,	44,907	673,605
Copper ingots, "	1,447	23,152
Mineral cake, "	18,588	157,998
" ore, "	62,959	157,397
Total,		$2,205,728

RECAPITULATION.

Silver bars—marcs,	893,254	$8,709,226
" ore—quintals,	211,568	3,173,520
Copper ingots, "	18,697	299,152
Mineral cake, "	148,852	1,265,242
" ore, "	269,363	673,407
Total,		$14,120,548

Of this amount, $11,910,668 went from the department of Copiapo, and $2,209,880 from those of Huasco.

The silver bars have been estimated at $9.75 to the marc; the ore, at $15 per quintal; the copper ingots, at $16 per quintal; the mineral cake, at $8.50 per quintal; and the crude ore, at $2.50 per quintal.

During the same period of time (two years and four months), the English Company at Copiapo exported to the value of $187,533, as follows:—

Gold,		$420
Silver—marcs,	3,144	30,654
Copper ore—quintals,	35,170.53	87,826.32½
Silver ore, "	4,332.34	64,985.10
Copper ingots, "	227.98	3,647.68
Total,		$187,533.10½

The mines of D. Josué Waddington, north of Caldera, have yielded 42,404 qtls. 70 lbs. of copper ore, which amount to $106,011.75 valued at $2.50.

The mine of *Buena Esperanza*, at Tres Puntas, which surpasses all others of the province in richness, has produced in six months of 1853—to wit, from January 1st to June 30th—the enormous sum of $495,151.05.

It is demonstrated that the mines, at a certain depth, degenerate into arsenical ores, more or less rich. This occurs at a less

depth in Tres Puntas than elsewhere. A small number of capitalists have purchased the ores for exportation abroad, thereby making a profit; and the miners, consulting their own interest, have generally sold not only the impure but also the virgin ores. This the Governor complains of, as detrimental to the industry of the republic.

THE PURCHASE OF MINES.

Every mine is divided into twenty-four barras. From the 1st of January, 1851, to April 30th, 1853, contracts were made for the purchase of 2,778 barras, at a value of $1,074,331.60, yielding to the treasury, under a tax of two per cent., $21,486.60.

Of this number of barras, 2,342 were of silver mines, at a value of $1,067,883; and 436 of copper, at a value of $25,634.

Of the silver, there were in Copiapo 2,151, valued at $1,056,307; and of copper, 384, valued at $18,024.

At Vallenar, 153 were barras of silver mines, valued at $10,102; and 28 copper, valued at $610.

At Freirina, 38 of silver, valued at $1,473; and 24 of copper, at $7,000.

SMELTING ESTABLISHMENTS.

In the departments of Huasco there are 25 establishments, with 34 furnaces, for smelting copper ore. At Vallenar there are 7 establishments and 16 furnaces. Only one uses coal; the others wood. The highest percentage of the ore smelted is 35 per cent., and the lowest 6 per cent. These establishments employ 286 men, 856 mules, 9 horses, 990 whims and 52 carts.

The other 18 establishments, in Freirina, have 24 furnaces, two of which use coal. The highest percentage of their ore is 30 per cent., and the lowest 9 per cent. They employ 322 men, 2,171 mules, 43 horses, 4,063 whims and 18 carts.

In this branch of industry, Copiapo has hardly done anything.

ESTABLISHMENTS FOR AMALGAMATING ORES.

The province contains, at present, 23 establishments for the amalgamation of silver ores. Two are located in the city of Vallenar, and the others, which are in the department of Copiapo, adopt the method of D. Juan Stevens, with the exception of two, which are intended for "benefiting" the poorer ores by grinding and smelting. The amount invested in machinery, etc., can be approximately estimated at $1,092,320.

One establishment for grinding, in operation since November, 1852, and to October, 1853, had "benefited" 8,482 quintals, the lowest of which yielded 14 marcs per carga, and the highest, 70 marcs per carga. The entire amount was 4,669 marcs.

The machine contains twelve (*toneles*) barrels, capable of "benefiting" six quintals each; two conical mills, with their respective sieves, for refining the powder; and three furnaces (*hornos*). There is, indeed, a steam engine, brought from England, to work a mill of double stones with its sieves; and another machine of twelve barrels (*toneles*), although of iron, for amalgamation, each capable of containing twelve quintals. The superintendents expected them to be in operation by January, 1854, and the establishment would be able, with this additional aid, to work 160 quintals daily.

The other establishment for smelting is located in the ravine of Rosario, south of and in the neighborhood of the city. It is in process of construction. The superintendents have obtained the exclusive privilege, for eight years, of smelting the ores of silver without the use of acids. They were constructing two fine furnaces, and the necessary offices, for this purpose, and hoped to have them in operation during the month of March last. Each furnace was expected to smelt daily 64 quintals of ore.

Owing to various circumstances, it has been impossible to procure the details of the returns of more than five of the remaining establishments. At these, there were "benefited," from January 1st, 1851, to June 30th, 1853, 43,824½ cargas, which yielded 461,586 marcs.

The richness of the ore averaged 196 marcs per carga of 64 quintals.

The richest ores "benefited" at some of the establishments were those from the mines *Manto Peralta*, yielding 6,983 marcs per carga; *Retamo*, yielding 2,708 marcs per carga; *San Jose*, 2,285; *Monto de Ossa*, 987.

Chanarcillo, Tres Puntas, Sacramento, Romero, and San Antonio, have yielded in the two years and six months above mentioned 121,692 cargas of ore, with the weight of 427,142 qtls. 1½ lbs.

In Copiapo, mining operations are on the increase. In 1842, 144 mines—4 of gold, 40 of copper, and 100 of silver—were opened; and in 1850, 255 were worked—6 gold, 14 copper, and 235 silver. The same progress appears in the other departments.

Only a few houses are established in the province which trade in the ores of the mines and products of the smelting works. The few transactions in silver bars in Copiapo are regulated by the prices at Valparaiso, discounting freight. The price of silver cake is $9; of copper ingots, $15 *a* $16 a quintal; and of silver ore, according to its richness per carga.

The product of silver in Copiapo in various years has been as follows:—

Year.	Marcs.	Year.	Marcs.
1830 . .	6,659	1842 . .	82,840 3
1831 . .	5,997	1843 . .	69,199 6
1832 . .	32,774 3	1844 . .	122,994 3
1833 . .	94,149 2	1845 . .	153,447 3
1834 . .	82,782 1	1846 . .	160,793 5
1835 . .	84,700 5	1847 . .	204,104 4
1836 . .	17,204 3	1848 . .	261,105 1
1837 . .	58,449 1	1849 . .	342,239 5
1838 . .	63,615 4	1850 . .	387,019 7½
1839 . .	103,765 2	1851 . .	353,719
1840 . .	19,248 7	1852 . .	395,695
1841 . .	82,112 1	1853, 4 months,	117,468
	Total, . . .		3,362,184 2½

THE PRICES OF ORES, ETC.

The price of copper ore of 20 per cent. is 15 reals per quintal, and decreases one real for each one per cent. down to ten, and increases in the same proportion up to 25 per cent.; above this, the increase is 15½ cts. per each one per cent.

One of the most serious embarrassments of the miners is the lack of water, and the high price it consequently commands.

The remainder of the Report treats of several legal enactments relative to the mines, and passes to notice the general necessities of the province. These it is not necessary to enter upon in these pages. The inexhaustible character of the mineral wealth of South America is wonderfully magnified in the mind by contemplating the active scenes in a single province of Chili.

ART. V.—A SKETCH OF THE GEOLOGY OF THE STATE OF MISSISSIPPI.—BY OSCAR MONTGOMERY LIEBER, LATE GEOLOGIST TO THE STATE OF MISSISSIPPI.

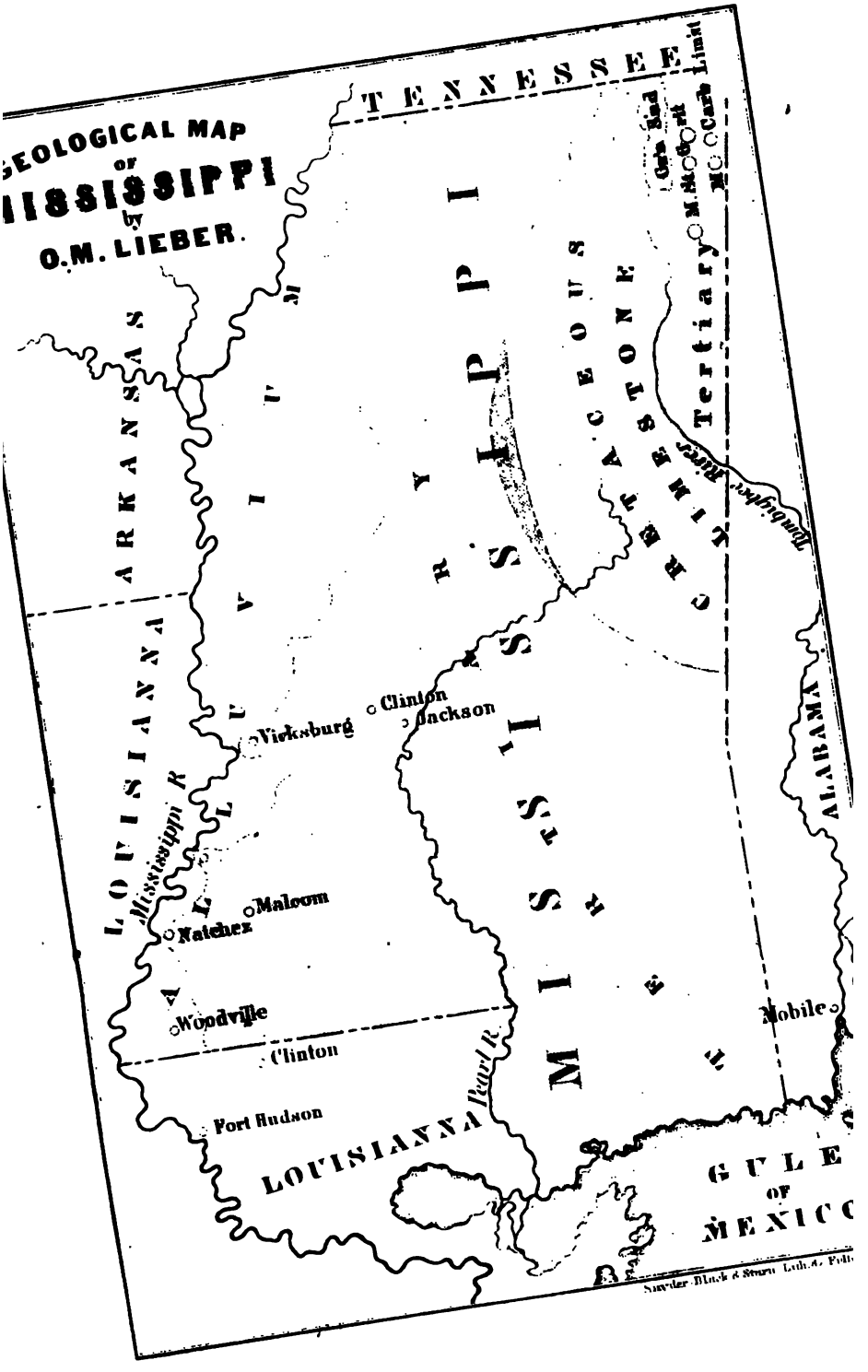
IT is now very nearly three years since I was elected Geologist to the State of Mississippi; for though I became nominally Assistant Professor of Geology at the State University, the duties were entirely confined to the geological survey. My connection with this office was somewhat brief; for, finding various specialities exerting an irksome influence on myself as well as the survey, I resigned, after having been occupied for seven months only, so that my examinations could but be of a cursory nature. Notwithstanding this, as I extended my survey over the whole State, omitting only the entirely unimportant portion, in order that I might be able to decide in what part of the State special investigations would be most necessary, I shall be able to give a very correct general view of the geology of that State, which was at

the time the extreme boundary of proper geological inspection. I am rather late in making this report, but still it is better than to allow the whole to pass into oblivion; for no report of mine was printed, and hence, there is little known of the geological features of Mississippi. It may appear strange that this article has been tendered to the Editors of this valuable Magazine, since mining, except possibly for coal, will scarcely find a field in that State, as the carboniferous limestone, or possibly a Silurian limestone, is the oldest formation to be found; but the subject is of sufficient interest, I believe, to merit its insertion.

Before proceeding to the report itself I would remark, that my investigations tally accurately with my esteemed and valued friend, Professor M. Tuomey's report of Alabama, dovetailing, if I may be permitted to use the term, in every respect into his; while this is by no means the case with regard to Dr. Troost's reports and map of Tennessee. In my opinion, the survey by the latter has created a very incorrect opinion of the geology of our South-western States. In his map we find almost the whole western half of Tennessee occupied by the cretaceous rocks, with no tertiary or alluvium whatsoever. In Mississippi there is no outcrop of the cretaceous in the northern portion of the State west of the eastern portion of Tippah, and, surely, geological formations cannot be supposed to take their course from the political boundaries of States! Dr. Troost may have discovered cretaceous limestone beneath the tertiary deposits in deep excavations or Artesian wells; but this does not afford sufficient grounds for omitting the superincumbent rocks in his map; for then we might place New Orleans on the cretaceous, because, in boring an Artesian well in that city recently, they are said to have penetrated this formation. Dr. Troost was, doubtless, misled by the fact that all this northern portion of the tertiary contains no fossils—at least, I was unable to discover any—and he may have regarded it as a recent accumulation of clay and sand, and, as such, may have thought it not worth while to allow it a place on his map.

I shall commence my report with the older rocks, and then gradually proceed with those of a more recent geological date, until we arrive at the alluvial deposits which form such a magnificent soil for the unsurpassable cotton plantations along the great "father of rivers."

The carboniferous limestone, or, possibly, a Silurian limestone, is the most ancient rock in the State. There is an outcrop of this limestone due south-east of Jacinto, the county seat of Tishamingo, where it is quarried for technical purposes. Unfortunately, I was unable to procure any fossils which might have enabled me to determine the exact geological position of this rock; and as I proposed to make more accurate investigations afterwards, I contented myself with a cursory examination of


GEOLOGICAL MAP
OF
MISSISSIPPI
BY
O.M. LIEBER.
TENNESSEE
ARKANSAS
LOUISIANNA
ALABAMA
MISSISSIPPI
Tertiary
Cretaceous
Limestone
Vicksburg
Clinton
Jackson
Natchez
Malcom
Woodville
Clinton
Port Hudson
Mobile
Pearl R.
Mississippi R.
GULF
OF
MEXICO

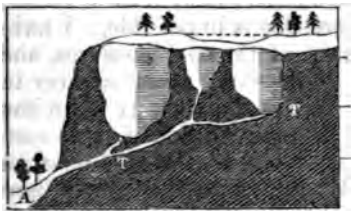
where it forms a northern fringe along the cretaceous limestone, running east and west through the State. Gentlemen residing in this portion of Mississippi informed me that they had discovered the valuable fertilizing qualities of the green-sand, and were using it in gardens, though, I believe, they had not extended its use to their fields, which, however, I urged them to do.

The cretaceous limestone, vulgarly termed the "rotten limestone," the rock of the prairies, embraces a very large portion of Mississippi; commencing in Tennessee, it enters Mississippi in the north-eastern corner of Tippah county and the north-western one of Tishamingo, and gradually widens towards the south, when it makes a curve and enters Alabama. The eastern boundary line in the county of Tishamingo is synonymous with the western margin of the green-sand, which is also the case in northern Itawamba. In the southern part of this county, where the green-sand is not visible, we find it adhering pretty closely to the banks of the Tombigbee, along which it passes through the counties of Monroe and Lowndes, and enters into Alabama east of Columbus. The western boundary of the prairie limestone takes a south-western course through Tippah, omits only a very small portion of Pontotoc and Chickasaw counties, grazes Yallabusha, divides Choctaw almost in the centre, includes nearly the whole of Winston and Kemper, a small angle of Neshoba, and a considerable portion of Lauderdale. The greatest breadth of this formation is between Choctaw and Lowndes counties. It is the richest in fossils in the State, if we take it in the aggregate; *exogyra, costata*, and *grœyphœa mutabilis*, being the most common. It furnishes some of the richest soils in the State, always excepting the alluvium of the Mississippi.

Of the tertiary there are two different fields; the one west of the cretaceous is, however, infinitely the most extensive, and embraces an area greater than all the other formations together. It stretches from Tennessee down to the coast of the Gulf of Mexico, and, in the southern portion of the State, extends from the Mississippi river to the Alabama line, except where, along the river, the alluvium encroaches upon it. The fossiliferous portion of this vast deposit seems to be confined to the bluffs near the river; and I have been unable to obtain a solitary fossil in the northern parts; still, the similitude between all these deposits and those of the far-famed locality of Vicksburg, as well as the majority of Southern tertiary rocks, leave no doubt of their geological date, nor is there any intermission, any material change, nor any other intervening formation. Ferruginous clays of a yellowish color seem to predominate; though, towards the south, there is a vast extent of sandy pine region. In the north, especially in the counties of Marshall, Tippah, and Lafayette, we find a very extensive and heavy deposit of a pure white pipe

clay. In some places it arrives at the immense thickness of seventy feet, but thins out towards the east. In this, or in close proximity with it, we find lignite, in more or less conspicuous quantities, and of a very dark color, so that it is not surprising that it should have been looked upon as veritable coal by those ignorant of geological facts and dates. In Attala county, at a place called Rockport, north-east of Kosciusko, we find a very substantial and firm tertiary sand-rock—a very fine-grained conglomerate, which differs considerably from the majority of the sand-rocks of this period, being far less loose in its construction. Nevertheless, from its position there is no possibility of its belonging to a more ancient formation.

Along the boundary of the tertiary, in Tunica county, I observed a very remarkable geological phenomenon. For about one to two hundred feet from the precipice there occur immense basins of greater depth than width in most cases, and with almost perpendicular sides, a narrow, and very even and regular ridge running round them, so that the whole presents the appearance of a gigantic honeycomb. Some of these I roughly estimate as over a hundred feet deep. I can only account for the excavations by the water, which might accumulate in slight depressions, finding or making subterranean channels, like those represented in the figure, through which gradually the earth was carried along. In the figure, "T" represents the tertiary, and "A" the alluvium.



The alluvium of the Mississippi river covers a very large extent of country, the chief bulk of which, in the State we are discussing, lies in the northern half, and consists principally of an island, bounded on the west by the Mississippi, on the north by the Yazoo Pass, on the east by the Tallahatchee and one of its tributaries, and on the south-west and south by the Yazoo river. This embraces the counties of Tunica (almost entirely), Cochoma, Bolivar, Sunflower, Washington, and Issequena. The alluvium, however, extends beyond this island, and includes a portion of Tallahatchee, Carroll, Holmes, Yazoo, and Warren, where the northern alluvium is bounded by a peninsula of the tertiary, which forms a bluff at Vicksburg. Then we have three smaller portions of the alluvial deposits; the first commencing in Warren, south of Vicksburg, and ending in Claiborne; the second beginning at the Rodney bluff, in Jefferson, and ending at the Natchez bluff, in Adams; the third commencing south of Natchez, embracing the greater portion of Wilkinson, and thence passing into Louisiana.

The mineral wealth of Mississippi is confined to the possible existence of coal. Iron is there also, but not in sufficient quantities for practical purposes. Lead ore, in the shape of rich sulphuret, has been found; but with regard to this, I may refer to the same appearance of the metal all over our Southern States, where it is constantly met with in portions of the country where it is geologically impossible that it should naturally exist. Professor Tuomey, in his "First Biennial Report on the Geology of Alabama," page 43, makes the following remarks under the head of "lead ore:"—"Fragments of sulphuret of lead, or galena, are scattered throughout the State in a manner that would indicate some common origin. Had they been confined to the region of the Silurian or carboniferous limestones, one might refer them to the ruins of veins of this ore that are often found in these rocks; but they are equally abundant where this is impossible. I have specimens picked up on the surface of the coal measures, and others from Clarke county, where no such veins can occur. Pieces of considerable size are found in the vicinity of Indian mounds; and the belief is induced that the position of these scattered fragments may be traced to Indian origin." In a note, on the same page, he observes:—"All States from which Indians have recently departed have legends of lead and silver mines, that were known to, but afterwards hidden by them; and the tenacity with which these are believed and retained is truly surprising. Journeys have been undertaken to the West to ascertain the position of these mines, but hitherto without success. The Indians, being no geologists, located the mines—in the cases that have come to my notice—in the most unpromising positions. The men with mineral rods have been industriously on the trail. I must do them the justice to say, that where they indicated the presence of 'mineral,' the excavation was neither expensive nor difficult. The one I last saw was in an Indian mound, on Village Creek, where the miners had reached within one foot of the vein!" A hasty glance at the map will show that lead can only occur in a very small portion of the State.

Mississippi will never be essentially other than an agricultural State, and as such it takes precedence over most other States of the Union, and produces, in various places, a greater amount of cotton than can ever be made in older States. The richest soil is undoubtedly the alluvium. But of it we have two varieties, as already mentioned, an older and a newer one. The former is of a more bluish color, while the latter is of a deep chocolate brown, and for agricultural purposes the best. This, as a rule, is found nearer the river than the former. Next in value, as arable land, we have some of the superficial deposits above the tertiary—as near Vicksburg; but the surface consists of small, but very abrupt hills, so that the soil soon washes away. The original growth is cane, pecan, and ash. At one time this

region was very popular for planting cotton, but now the swamp is naturally preferred. The cretaceous formation ranks next as a fine soil-giving rock. The prairies are distinguished by two appellations, relating to their character of soil and native vegetation—the bald and the post-oak prairies. The former very frequently contain too much lime to afford the best growth for cotton or corn. The latter is always good for these purposes. The *quercus obtusiloba* is almost the only tree found upon these lands. The greater portion of the soils which owe their origin to the tertiary deposits, with the exception of those in the neighborhood of Vicksburg, can only claim mediocrity, as the soil is very thin, and, though very fair in itself, is soon transferred from its original position, if not worn out while still remaining there, and is then carried away to the river bottoms and hammock lands. The latter result has been materially hastened by injudicious tillage. A great portion of the tertiary—almost the whole south-eastern part, as well as that in the north-east—consists of heavy beds of sand, which can produce but little, and can scarcely be said to enjoy any cultivation at all; for the facility of acquiring more valuable lands is still sufficiently great to enable those, who can at all afford to move, to leave these barren pine lands. In the counties of Tishamingo and Itawamba—except where the cretaceous rocks appear—we meet with perhaps the poorest land that can be found in the State, as may be inferred from the fact, that United States' land may still be bought there for 12½ cents an acre.

JOURNAL OF MINING LAWS AND ORGANIZATIONS.

NEW YORK AND SHAWANGUNK MINING COMPANY.

This Company held their annual meeting June 6th, when the following Directors were elected:—

A. Wellington Hart, David Cotheal, Andrew Thompson, Charles Rhinelander, Zebedee Cook, J. Patten, Jr., Walter C. Green, Joseph M. Brown, J. Black, Silas R. Selden, D. Wilson, and Charles Cleveland. The capital at par value is $700,000, in 140,000 shares, $5 each. The President of the Company, David Cotheal, has succeeded Mr. Hart, who resigned.

OHIO LAND AND MARBLE COMPANY.

The stockholders of the Ohio Land and Marble Company elected, on the 7th inst., the following parties as Trustees for the ensuing year:—

Thomas P. Kettell, Henry Warren, William J. Dezeng, John M. Cantine, Augustus J. Brown, John O'Brien, William Burnett, Amasa A. Lyon, and Edward Warren; and, at a subsequent meeting of the Board, T. P. Kettell was re-elected President, and the other officers were also re-elected.

CONTINENTAL MINING COMPANY.

The following Board of Directors and Officers were elected by Continental Mining Company, on June 18th :—

Samuel W. Hill, Horatio Bigelow, A. H. Hanchett, W. F. Roelosson, E. P. Morgan, J. Venen Brown, and C. T. Harvey, Directors. Samuel W. Hill, President and General Superintendent. Horatio Bigelow, Secretary and Treasurer.

EMPIRE MINING COMPANY.

The following persons were elected Directors of said Company, on June 13th:—

Samuel F. Tracy, C. J. Stedman, D. Bethune Duffield, Sylvester Larned, and J. Venen Brown, Directors. Samuel F. Tracy, President. J. Venen Brown, Secretary and Treasurer.

RIPLEY COPPER COMPANY.

At the annual meeting of the stockholders of this Company, held at the Treasurer's office, Boston, May 17th, the following Board of Directors were unanimously elected :—

Henry Weld Fuller, of Boston; Stephen Ball, A. W. Spencer, Horatio Bigelow, and H. J. Bukley, of Detroit, Michigan. At a subsequent meeting of the Directors, H. Weld Fuller was re-elected President; H. Bigelow Secretary and Treasurer.

HOWARD MINING COMPANY.

At the annual meeting of this Company, held at their office, in Boston, June 5th, the following Board of Directors were unanimously elected :—

William S. Thatcher, of Boston; Benjamin F. Hallet, Benjamin Howard, Aaron Hobart, Jr., William E. Coffen, Edward F. Adams, and Luther W. Clarke, of Michigan. At a subsequent meeting of the Directors, W. S. Thatcher was chosen President, and Edward F. Adams Secretary and Treasurer. The stock is divided into 20,000 shares, the subscription price to which was $2.50 per share.

NEW ENGLAND COPPER COMPANY.

The annual meeting of the stockholders was held at the office of the Company, Nos. 9 and 11 Kilby street, Boston, June 5, when the following list of Directors was unanimously elected :—

G. P. Loring, of Boston; James W. Stone, William G. Howe, David Perkins, George S. Harris, Alvin Smith, of Enfield; Luther W. Clarke, of Michigan. At a subsequent meeting of the Directors, G. P. Loring was elected President, and G. S. Harris Secretary and Treasurer.

CLARK MINING COMPANY.

The following Directors were unanimously elected at the annual meeting, held at the Treasurer's office, in Boston, June 7th :—

John T. Heard, of Boston; Henry Mellus, J. W. Clark, H. Bigelow, and Walter A. Northup, of Michigan. At a subsequent meeting of the Directors, John T. Heard was chosen President, and Horatio Bigelow Secretary and Treasurer.

NORTH WESTERN MINING COMPANY.

At the annual meeting of the North Western Mining Company, held at Detroit, June 13th, the following Board of Directors was unanimously re-elected:—

J. K. Moorhead, of Pittsburg, Pa., President; C. G. Hussey, Thomas M. Howe, James M. Cooper; Secretary and Treasurer, H. N. Walker, of Detroit, Michigan.

HIWASSEE MINING COMPANY.

Directors, Samuel F. Tracy, Warren Delano, Jr., Walter C. Green, Henry L. Pierson, George H. Dunscomb, Alfred Ogden, Leonard S. Suarez; President, Samuel F. Tracy; Secretary, Henry Ward Barnes; General Agent at the mines, Alexander Dellisser; Mining Captain, John Harris.

CUMBERLAND COAL AND IRON COMPANY.

President, Andrew Mehaffey; Directors, William D. Thompson, E. W. Dunham, Joseph Torrey, Francis Bloodgood, Joseph Tuckerman, Moor N. Falls, Baltimore; Lowell Hollbrook, Thomas Tileston, H. B. Loomis, D. R. Martin, Thomas W. Gale, Lambert Gittings, Baltimore; Edward F. Loomis, Secretary.

NEW YORK AND CONCORD GRANITE COMPANY.

President, John C. Angell; Secretary, Augustus Jenkins; Treasurer, Reuben F. Foster, Concord; Auditor, James Moore; Superintendent of Works, Luther Roby and son, Concord; Solicitor, Richard F. Fuller, of Boston. Trustees, John C. Angell, Richard H. Johnson, William H. Coffin, Augustus Jenkins, New York; Reuben F. Foster, Concord, New Hampshire.

ACT OF INCORPORATION IN MISSOURI.

An Act to authorize the formation of Corporations for Manufacturing, Mining, Mechanical, or Chemical purposes.

Be it enacted by the General Assembly of the State of Missouri, as follows:—§ 1. At any time hereafter, any three or more persons who may desire to form a company, for the purpose of carrying on any kind of manufacturing, mining, mechanical, or chemical business, may make, sign, and acknowledge, before some officer, competent to take the acknowledgment of deeds, and file in the office of the circuit clerk of the county in which the business of the company shall be carried on, and a duplicate thereof in the office of the Secretary of State, a certificate in writing, in which shall be stated the corporate name of the said company, and the object for which the company shall be formed; the amount of the capital stock of the said company, which shall not be more than five hundred thousand dollars, nor less than five thousand dollars; the term of existence, not to exceed fifty years; the number of shares of which the said stock shall consist; the number of directors, and their names, who shall manage the concerns of the company for the first year, and the names of the town and county in which the operations of the said company are to be carried on.

§ 2. When the certificate shall have been filed as aforesaid, then the aforesaid clerk shall issue a license to the persons who shall have signed and acknowledged the same, on the reception of which, they and their successors shall be a body politic and corporate, in fact and in name, by the name stated in such certificate, and by that name have succession, and shall be capable of suing and of being sued, in any court of law or equity, in this State; and they and their successors may have a common seal; and may make and alter the same at pleasure; and they shall, by their corporate name, be capable in law of purchasing, holding

and conveying any real and personal estate whatever, which may be necessary to enable the said company to carry on their operations named in such certificate, but shall not mortgage the same, or give any lien thereon.

§ 3. The stock, property and concerns of such company, shall be managed by not less than three, nor more than nine directors, who shall respectively be stockholders in such company, and citizens of the United States, and a majority of whom shall be citizens of this State, who shall, except the first year, be annually elected by the stockholders, at such time and place as may be directed by the by-laws of the company; and public notice of the time and place of holding such election, shall be published not less than ten days previous thereto, in the newspaper printed nearest to the place where the operations of the said company shall be carried on; and the election shall be made by such of the stockholders as shall attend for that purpose, either in person or by proxy. All elections shall be by ballot, and each stockholder shall be entitled to as many votes as he owns shares of stock in the said company; and the persons receiving the greatest number of votes shall be directors; and when any vacancy shall happen among the directors by death, resignation, or otherwise, it shall be filled for the remainder of the year, in such a manner as may be provided for by the by-laws of the said company.

§ 4. In case it shall happen at any time that an election of directors shall not be made on the day designated by the by-laws of said company, when it ought to have been made, the company, for that reason, shall not be dissolved, but it shall be lawful, on any other day, to hold an election for directors, in such manner as shall be provided for by the said by-laws; and all acts of directors shall be valid and binding as against such company, until their successors shall be elected.

§ 5. There shall be a president of the company, who shall be designated from the number of directors; and also such subordinate officers as the company, by its by-laws, may designate; who may be elected or appointed, and required to give such security for the faithful performance of the duties of their offices, as the company by its by-laws may require.

§ 6. It shall be lawful for the directors to call in and demand from the stockholders respectively, all such sums of money by them subscribed, at such times, and in such payments or installments, as the directors shall deem proper, under the penalty of forfeiting the shares of stock subscribed for, and all previous payments made thereon, if payment shall not be made by the stockholders within sixty days after the personal demand, or notice requiring such payment shall have been published for six successive weeks in the newspaper nearest to the place where the business of the company shall be carried on, as aforesaid.

§ 7. The directors of such company shall have power to make such prudential by-laws as they shall deem proper, for the management and disposition of the stocks and business affairs of such company, not inconsistent with the laws of the State, and prescribing the duties of officers, artificers, and servants that may be employed; for the appointment of all officers, and for carrying on all kinds of business within the objects and purposes of such company.

§ 8. The stock of such company shall be deemed personal estate, and shall be transferable in such a manner as shall be prescribed by the by-laws of the company; but no share shall be transferable until all previous calls thereon shall have been fully paid in, or shall have been declared forfeited for the nonpayment of calls thereon. And it shall not be lawful for such company to use any of their funds in the purchase of any stock in any other corporation.

§ 9. The copy of any certificate, or license of incorporation, or journal of proceedings of such company, filed in pursuance of this act, certified by the circuit clerk or his deputy to be a true copy, and of the whole of such certificate or license or journal, shall be received in all the courts and places, as presumptive legal evidence of the facts therein stated.

§ 10. All the stockholders of every company incorporated under this act, shall be severally individually liable to the creditors of the company in which they are stockholders, to an amount equal to the amount of stock held by them respectively, for all debts and contracts made by such company, until the whole amount of capital stock fixed and limited by such company, shall have been made and recorded, as prescribed in the following section; and the capital stock so fixed and limited, shall all be paid in, one-half thereof within one year, and the other half thereof within two years from the incorporation of said company, or such corporation shall be dissolved.

§ 11. The president, and a majority of the directors, within thirty days after the payment of the last installment of the capital stock so fixed and limited by the company, shall make a certificate stating the amount of the capital so fixed and paid in; which certificate shall be signed and sworn to by the president, and a majority of the directors; and they shall, within the said thirty days, record the same in the office of the circuit clerk of the county wherein the business of said company is carried on.

§ 12. Every such company shall annually, within twenty days from the first day of January, make a report, which shall be published in some newspaper published in the town, city, or village, or if there be no newspaper published in said town, city, or village, then in some newspaper published nearest the place where the business of said company is carried on, which shall state the amount of capital, and of the proportion actually paid in, and the amount of its existing debts; which report shall be signed by the president and a majority of the directors, and shall be verified by the oath of the president or secretary of said company, and filed in the office of the circuit clerk of the county where the business of the said company shall be carried on; and if any of said companies shall fail so to do, all the directors of the company shall be jointly and severally liable for all the debts of the company then existing, and for all that shall be contracted before such report shall be made.

§ 13. If the directors of any such company shall declare and pay any dividend, when the company is insolvent, or any dividend, the payment of which would render it insolvent, or which would diminish the amount of its capital stock, they shall be jointly and severally liable for all the debts of the company then existing, and for all that shall be thereafter contracted, while they shall respectively continue in office; *Provided*, that if any of the directors shall object to the declaring of such dividend, or to the payment of the same, and shall, at any time before the time fixed for the payment thereof, file a certificate of their objections in writing, with the clerk of the company, and with the circuit clerk of the county, they shall be exempt from the said liability.

§ 14. Nothing but money shall be considered as payment of any part of the capital stock, and no loan of money shall be made by any such company to any stockholder therein; and if any such loan shall be made to a stockholder, the officer who shall make it, or who shall assent thereto, shall be jointly and severally liable to the extent of such loan, and interest, for all the debts of the company contracted before the repayment of the sum so loaned.

§ 15. If any certificate, or report made, or public notice given by the officers of any such company, in pursuance of the provisions of this act, shall be false in any material representation, all of the officers who shall have signed the same, knowing it to be false, shall be jointly and severally liable for all the debts of the company contracted while they are stockholders, or officers thereof.

§ 16. No person holding any stock in such company as executor, administrator, guardian or trustee, and no person holding such stock as collateral security, shall be personally subject to any liability as stockholder of such company; but the person pledging such stock shall be considered as holding the same, and shall be liable as stockholder accordingly; and the estates and

funds in the hands of such executors, administrators, guardians or trustees, shall be liable in like manner, and to the same extent, as the testator or intestate, or the ward or person interested in such trust fund would have been, if he had been living, and competent to act and hold the same stock in his own name.

§ 17. Every such executor, administrator, guardian or trustee, shall represent the share of stock in his hands at all meetings of the company, and may vote accordingly as a stockholder; and every person who shall pledge his stock as aforesaid, may nevertheless, represent the same at all such meetings, and may vote accordingly as a stockholder.

§ 18. The stockholders of any company organized under the provisions of this act, shall be jointly and severally individually liable for all debts that may be due and owing by the company, to the amount of profits which have accrued, or dividends which have been declared and paid upon their stock respectively, and no further.

§ 19. It shall be the duty of the directors of every company organized under the provisions of this act, to cause to be kept a regular journal of their proceedings, in which shall be recorded all the proceedings and orders made by the directors, and also a book, in which shall be recorded the exact amount of profits which has been made, and losses which have been sustained by the company, and all dividends which have been declared and paid, with the amount of such dividends, and the dates when declared, and the persons to whom paid; a copy of which journal, and all books required by this act to be kept, shall be filed annually with the circuit clerk of the county in which such company is located, where they shall be kept [open] upon for the inspection of all persons interested.

§ 20. Any corporation heretofore formed, or company, either by special act or under the general law, and now existing, for any manufacturing, mining, mechanical or chemical purposes, or any company which may be formed under this act, may increase or diminish its capital stock, by complying with the provisions of this act, in any amount which may be deemed sufficient and proper for purposes of the corporations; and may also extend its business to any other manufacturing, mining, mechanical, or chemical business, subject to the provisions and liabilities of this act. But before any corporation shall be entitled to diminish the amount of its capital stock, if the amount of its debts and liabilities shall exceed the amount of capital to which it is proposed to be reduced, such amount of debts and liabilities shall be satisfied, and reduced so as not to exceed such diminished amount of capital; and any existing company heretofore formed under the general law, or any special act, may come under, and avail itself of the privileges and provisions of this act, by complying with the following provisions; and thereupon such company, its officers and stockholders, shall be subject to all the restrictions, duties, and liabilities of this act.

[To be continued.]

COMMERCIAL ASPECT OF THE MINING INTEREST.

NEW YORK MINING SHARE MARKET.

New York, June 20, 1854.

Mining stocks have fairly given way since our last report. In fact one or two which were considered favorites have fallen extremely low. North Carolina has dipped to $, and all the expectations raised, vanished. It appears their debt is $50,000, and the proceeds of the last lot of ore sent to market

were not sufficient to pay expenses of transportation. The stockholders are now called upon to elect the payment of 50 cents per share, to relieve the liabilities, or run the chance of losing the mine. The property is represented as one which will pay well with economical management.

From the *Ulster* Company, a dividend was expected last February. They now show a debt of $16,000, with no means of liquidation. The property, if properly conducted, can be made profitable.

The losses and disappointments from these two companies have weakened confidence in others, and make parties pause before they decide to invest again.

In other mining stocks, however, the fall, notwithstanding the distrust, has not been proportionately greater than in other stocks.

Phœnix Gold stands firm at from 50 to 60 cents, and the accounts from the mine were never more satisfactory. It is free from debt, has a small capital, and with but little machinery erected is more than paying its expenses.

Parties who have recently returned from *Gold Hill* give wonderful accounts of the productiveness of the mine, and think the return will in future be greater than ever. Everything here is conducted upon a careful and systematic style, and among the stockholders are shrewd and business-like men.

In the Lake Superior companies there has been hardly a transaction, but the prices are wonderfully low, considering the great accounts received from the mines. We look for a large advance on them after the dull season is over.

Cumberland Coal tends upward with a good prospect. It is stated that negotiations are going on between the Committee of Directors of the Parker Vein Company and one of the old managers, by which it is supposed a considerable amount of the money received for the over-issued stock will be recovered. The over-issue is now about 81,000 shares.

Some orders for *Breckenridge* Coal have been received from Europe.

At a meeting of the stockholders of the *Deep River* Company, a proposition was made by the Directors, and accepted by the majority, to subscribe two cents per share per month for working capital during the four ensuing months, which is considered sufficient on two-thirds of the capital stock of 100,000 shares to put the mine in a paying condition.

At the *McCulloch* Mine, the machinery is as yet hardly all in operation, but the advices of the Company are quite favorable.

Some sales of *Borden's Gold Crusher* Company's stock have been made at $1 to $4½ per share. The movement is based upon an arrangement with the English Company, by which a royalty is obtained upon machines sold to California.

The *Gardiner Gold* Company expect to have their machinery in operation early in July.

The *Chatham Cobalt* Company have concluded their contracts for the necessary engine and building, machinery, etc. A force of 30 men is at present employed. The level has been pushed to the length of 300 feet, with the character of the vein improving as the work progresses, and the engine shaft has attained a depth of 70 feet. The Superintendent reports the discovery of a new vein 1½ feet thick that promises well for copper.

[Continued on page 55.

Fluctuations to June 20th, 1854, in the different Mining Stocks sold at the New York Stock Exchange and Mining Boards, showing their Highest and Lowest Points, and the Date, with the Market Value at this date, Gain or Loss for the month, and number of Shares sold.

Name of Stock.	Shares.	Par.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value June 20.	From May 20. Gain	From May 20. Loss.	Shares Sold.
Aberdeen	—	—	1	8	—	—	1	—	—	100
Algomah Copper	20,000	25	—	—	—	—	—	—	—	—
Alleghany Coal	—	—	—	—	—	—	—	—	—	—
American White Zinc	—	—	1	7	¼	12	¾	—	¼	2,250
Brookdale Lead	—	—	—	—	—	—	—	—	—	—
Buckingham Gold	100,000	5	—	—	—	—	—	—	—	—
Breckenridge Coal	—	—	100½	15	100	9	100	—	—	70
Caledonia Coal	—	—	4¾	29	4	5	4	—	¼	2,950
Calloway	—	—	—	—	—	—	¾	—	—	—
Charlotte Copper	—	—	—	—	—	—	—	—	—	—
Chatham Cobalt	100,000	5	—	—	—	—	—	—	—	—
Conrad Hill Gold	—	—	35c.	22	25c.	14	25c.	—	—	8,150
Copper Falls Copper	10,000	—	—	—	—	—	—	—	—	—
Cumberland Coal	50,000	100	39½	27	31¾	22	35	3½	—	100,820
Dauphin and Susquehanna Coal	22,000	50	—	—	—	—	20	—	—	—
Dauphin and Susquehanna 7 per cent. Bonds	—	—	—	—	—	—	—	—	—	—
Dolly Hyde Copper	—	—	—	—	—	—	—	—	—	—
Duchess Silver	—	—	3	25	1	31	1	—	2	750
Douglas Houghton Copper	—	—	7	31	5	26	4½	—	½	116
Flint Steel	—	—	5	30	5	6	5	—	—	450
Fulton Copper	100,000	5	1½	25	⅞	14	⅞	—	⅛	—
Franklinite Scrip	—	—	—	—	—	—	4	—	—	—
Gardiner Crusher	—	—	—	—	—	—	—	—	—	—
Gardiner Gold	400,000	5	2½	6	2	16	2¼	—	¼	6,500
Georgia Gold	—	—	1⅜	24	1½	10	1½	—	⅛	1,500
Gold Hill	200,000	5	3½	3	3⅜	16	3½	—	¼	6,400
Hiwassee Copper	—	—	6	27	5½	30	6	—	—	1,100
Isle Royale Copper	12,000	10	—	—	—	—	—	—	—	—
Lindsay Gold	100,000	10	60c.	31	60c.	17	60c.	—	15c.	1,500
McCullough Gold & Copper	200,000	5	5½	5	4¾	16	4¾	—	¼	900
Manitou Copper	20,000	5	—	—	—	—	—	—	—	—
Manassas	—	—	¾	15	½	14	¾	¼	—	700
Mineral Mining Co	100,000	10	—	—	—	—	—	—	—	—
Middletown Silver Lead	—	—	—	—	—	—	—	—	—	—
Montgomery Zinc	80,000	12½	—	—	—	—	—	—	—	—
National Copper	10,000	25	—	—	—	—	—	—	—	—
Neuvitas Copper	—	—	—	—	—	—	—	—	—	—
New Creek Coal	200,000	10	2½	22	2½	31	2½	—	½	750
New Jersey Zinc	96,000	12½	7¾	22	7	16	7	—	1	11,350
North American Copper	10,000	—	—	—	—	—	—	—	—	—
North Carolina Copper	—	5	2½	23	⅞	16	1	—	1¼	18,950
Ohio Land & Marble	30,000	100	—	—	—	—	—	—	—	—
Passaic Mining & Manufacturing Co	—	—	7½	1	7	1	6	—	1½	200
Pennsylvania Coal	60,000	50	106½	3	103½	16	104	—	⅞	2,485
Pennsylvania & Lehigh Zinc	100,000	10	3½	22	2¼	16	2½	—	¾	8,950
Phœnix Mining and Manufacturing Co	20,000	100	—	—	—	—	—	—	—	—
Phœnix Gold	100,000	3	70c.	24	52½	10	60	—	15c.	1,200
Potomac Copper	100,000	10	3½	23	2½	16	2½	—	¼	3,900
Potosi Lead	200,000	5	—	—	—	—	—	—	—	—
Randolph	—	—	—	—	—	—	—	—	—	—
Ripley Copper	40,000	12½	—	—	—	—	—	—	—	—
Rockland	—	—	—	—	—	—	—	—	—	—
Rocky Bar Gold	—	—	—	—	—	—	—	—	—	—
Rutherford Gold	—	—	—	—	—	—	—	—	—	—
Toltec Copper	20,000	25	—	—	—	—	—	—	—	—
Ulster Lead	—	5	1½	26	½	16	½	—	⅛	1,450
Vandenberg Gold & Copper	100,000	—	½	1	½	1	½	—	—	100
Vermont Copper	—	—	2	25	2	25	2	—	—	200
Winthrop Copper	20,000	25	—	—	—	—	—	—	—	—
Wyckoff Gold	—	—	2	30	2	30	1¾	—	1½	500

Note.—There has been no sale of the stocks of those Companies opposite to which the above table is blank. Our reports in a former Number furnish the amount of the last sales.

The accounts from the Isabella Mine, Tennessee, are that 500 to 800 tons of black oxide ore have been taken out in driving levels and sinking shafts, which is being shipped to Baltimore, where the Company have just sold 200 tons at $1.25 per ton. It is stated that the Company can take out 200 to 300 tons per month, without more ground open than they have at present.

At the meeting of the *Empire* Mining Company, of Lake Superior, an assessment of 50 cents per share was called, payable in two installments on the first of August and September next.

An assessment of $1 per share has been called on the Lake Superior *Continental* Mining Company, payable to the Treasurer of the Company, at Boston, in four monthly installments, commencing July 15th.

The *Schuylkill Navigation* Company gives notice that on and after the 3d proximo, and until further notice, the toll on anthracite coal will be advanced 20 cents per ton, to all points. The advance in the rate of tolls on the Reading Railroad Company is 30 cents per ton.

BOSTON MINING SHARE MARKET.

BOSTON, June 20, 1854.

The past month has been an unusually quiet one in mining stocks, and we have but few features of interest or importance to note. With some exceptions, there has been a general decline in mining shares, and especially those representing the "*young mines*," which have not yet been sufficiently developed to satisfy those who expect success as if by *magic*, without any expense of capital or consumption of time. This too prevalent feeling doubtless operates to the injury of mining interests, and, in fact, prevents their development at as early a period as would otherwise be the case. People invest their money in railroads, and sometimes, after waiting years for a dividend, even then find themselves farther from it than ever, while their stock has grown "smaller by degrees," until its market value has become almost a unit. This is submitted to with a commendable grace; but turn the tables, and let a Copper Company start with $100 per share paid in, and, after making new stock several times at depreciated rates, become an almost worthless concern, when should we hear the last of it? On the contrary, our mining companies begin with almost nothing, and, thus far, two of those which have made returns to their stockholders, have divided $69 and $30 per share, for $18.50 and $22 paid in, respectively. These two Companies, the *Pittsburg* (Cliff) and *Minnesota*, are the pioneers in the cause, and a criterion of what others *will be*—though it is thought that even their success, to all appearance now so brilliant, will be entirely eclipsed by the future of some of the companies now fast approaching a period when their shareholders will reap the reward of patient perseverance through the numerous difficulties which naturally attend the thorough development of any mine. Some people do *not* believe in copper mining, though it is probably unnecessary to tell our readers that we *do*, and time will surely prove which of us is in the right.

The principal feature in the Stock Market since our last has been the rapid and well sustained rise in *Pittsburg Copper Company*, which has improved from 137 to 153½, within a month past. There are few shares for sale; and

even this advanced price is reasonably cheap for a stock of its character. In order to preserve it for future reference, we give below an interesting table of the movements in this stock from January, 1851, showing the

Fluctuations in Pittsburg and Boston (Cliff) Mining Company Stock, from January, 1851, to May, 1854, inclusive, with the highest and lowest sales and the date; also the number of Shares sold each month at the Boston Stock Exchange Board.

Date.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Shares Sold.	Date.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Shares Sold.
Jan. 1851..	—	—	—	—	No sale.	Oct. 1852 .	115	2	115	19	9
February .	96	28	90*	19	55	November	—	—	—	—	No sale.
March . . .	98	29	95	10	157	December	124	31	124	31	10
April . . .	123	29	98	1	156	Jan. 1853 .	130	11	125	3	33
May	125	2	124	27	57	February .	141*	19	140	3	3
June . . .	—	—	—	—	No sale.	March . . .	150	28	142	5	46
July	120	17	116½	28	24	April . . .	195	20	158	1	79
August . .	106½	11	102½*	18	60	May	180	10	175	4	6
September	100	8	98	10	12	June. . . .	—	—	—	—	No sale.
October . .	—	—	—	—	No sale.	July	172½	11	170	27	6
November.	102	17	95	1	71	August . .	172	2	172	2	9
December.	99	5	98	5	18	September	160*	14	149*	26	54
Jan. 1852 .	95½	6	95½	6	10	October . .	151	27	150	5	21
February .	100*	14	100*	14	5	November	151½	7	149	22	21
March . . .	108	6	108	19	8	December	150	31	140	19	121
April . . .	—	—	—	—	No sale.	Jan. 1854 .	150	2	147½	24	41
May	107	17	107	17	7	February .	147*	9	144½*	25	47
June. . . .	—	—	—	—	No sale.	March . . .	145½	17	143½	2	28
July	110	29	109	9	20	April . . .	142½	11	137	29	8
August . .	112*	30	112*	30	20	May	153½	31	137	3	22
September	115	8	114	1	28	Total. . .	.....	....	.....	....	1242

* Extra dividend.

The highest sale during the time included in the above table (forty-one months) was 195, in April, 1853, at a season of great speculative excitement in this market among copper stocks. The lowest sale for the same time was 90, in February, 1851, and no shares have been sold less than $100 since February, 1852. The amount of stock sold is usually small, the average per month for over three years being only thirty shares; and, during a period of forty-one months, less than one-fifth of the whole capital was publicly sold at the Brokers' Board, Boston.

Although the dividends paid by the Pittsburg Company have already been published in Vol. II., page 295, of this Magazine, we again insert them here as a valuable addition to the above table of fluctuations in the stock:—

	1849.	1850.	1851.	1852.	1853.	1854.
February.	—	$7	$5	$5	$7½	$10
August	*$10	7	5	5	7½	—

Forest stock has been subject to many fluctuations since May 1st, having declined to 9¼ on the 9th of that month, from which it immediately advanced until touching 12½ on the 27th. Since that time it has gradually receded,

* This was the first dividend, and was paid in May, 1849. The Company will undoubtedly pay $10 per share in August next. By the above it will be seen that the total amount already divided is $69 per share, being $50½ per share above the amount assessed on the stock, which should certainly satisfy all reasonable men that, at least, *one* Copper Company has been eminently successful; and, with due patience, equal, or better results will be quite sure to follow from other Companies.

and to-day (June 20) sold at 10¼. These fluctuations have little reference to the real value of the stock however, as the mine never made a better show than at the present time. There is little doubt that the Company will ship 100 tons of copper this season, and worth, at least, $50,000, notwithstanding the delay occasioned by the burning of their saw-mill and stamping works. Although the loss was an unfortunate one in itself, it will probably be a real benefit to the Company in the end, as by it they will obtain new and more powerful machinery, thus enabling them to push forward their work with greater dispatch. Twenty-five tons of copper had been shipped at last dates, and twenty-five tons more were prepared for shipment. 89,202 lbs. of copper, all mass and barrel work, were raised in the month of April, and put up for shipment—estimated at 70 per cent. pure copper, and valued at 22 cents per lb., or $6,644.44. The total expenses of the month, working 127 men, were $4,913.29, leaving a balance over expenses of $1,731.15. The new stamp works, with thirty-two heads, will be running by the 1st of August, which, with the mass and barrel work, will give nearly forty tons of copper per month. The Company have sufficient ground open for more than one year's stoping, and with a wide, rich vein, there is no good reason to doubt their final success. A report was started, a month or more since, that the Forest Company had lost *twenty tons* of copper, by being thrown overboard in the lake during a severe gale, which is so entirely inaccurate that we here give the true statement. Only twenty *barrels* of copper, averaging 600 lbs. each, were thrown over, being the property of *four* different companies, and but *eight* barrels of which belonged to the Forest, *fully insured* for $440 per ton; so that the Company met with no loss at all. In order to set the matter right, in any future losses which may occur to either of the following Boston companies—

Algomah,	Glen,	Phœnix,
Clark,	Hazard,	Ripley,
Copper Falls,	Humboldt,	Toltec,
Dana,	Huron,	Winthrop,
Forest,	Native,	

we are informed by Horatio Bigelow, Esq., the treasurer, *that all supplies sent to the mines, and all copper shipped from them, are always fully insured* on an open policy—a fact of no little importance to those interested in the companies named.

National has been fully offered in the market during a few weeks past, but just now there is a scarcity of stock, the latest advices from the mine being exceedingly favorable. It is stated that the Minnesota vein *has been found and traced west*, and makes a splendid show as far as the exploration has extended. It is full of barrel and stamp work, with pieces of from one to thirty pounds occurring at the *surface*. In places the vein is six feet in width, and although the past success of the mine has been a marked one, the indications now are far beyond any previous exhibition. The possession of the Minnesota vein, *in addition* to the National vein—well known to be very rich—will place this mine in the front rank at the Copper regions.

Minnesota has sold at 180 within a few days, which is an improvement of $10 per share for the month, and there is little stock offered for sale. The late discovery of silver at this mine has attracted no little attention, and should the anticipations of some of the friends of the Company be realized, the stock will be very valuable. We have never had great faith in the profitable working of silver among the copper mines of Lake Superior; but the last discoveries at the Minnesota are certainly of such a nature as to give good encouragement to the hopes of those who are believers. *Copper Falls* advanced from 59¼ to 64½, but has since receded to 56¼, although at this point there is an active demand for the stock. Operations at the mine are going on with great promptness and dispatch, the copper being rapidly prepared and forwarded to the lake for shipment. We have had no details from the mine very lately, the time of the Superintendent, Mr. Hill, being almost wholly employed in vigorous exertions towards making up the 400 tons of copper, which he is bound to ship during the season, because he has promised it, and never says what he does not mean. *Isle Royale* is progressing favorably, and the mine never made a better show. The stock has declined to 17, however, in consequence of a dull and heavy market. No one doubts the real value of the mine however, and everything is being done to develop it as fast as practicable. *Summit* is held firm at $5, and the mine is steadily improving, with every prospect of success. The last advices are excellent. *Toltec* has declined to 5¼, very much to the surprise of every one, and it is now looked upon as one, at least, of the cheapest stocks in the market. The mine is improving in its parts, and there is little doubt of its final and complete success.

There has been a general decline among the shares of the low-priced companies, some of them having touched points beyond which the margin for a decline is exceedingly small. *Dana* has sold for 50 cents, but is now a trifle better. *Fulton* is freely offered at 87½ cents, without buyers. *Bay State*, *Glen*, *Boston*, *Shawmut*, and *Webster*, are held at about $1. *Manassas* has no quotable price here, but we notice sales in New York at 25 cents per share. *Algomah* has declined to 2⅝, and *Winthrop* 1⅝, both of which are good purchases. *Norwich* has declined to 7 asked, and only 5 bid. We notice that a meeting of the stockholders in this Company has been called in New York (June 30), "to vote on an increase of capital," or, in other words, to lay further assessment, which is probably the cause of the depreciation in the stock. *Star* holds firm at $6, without transactions for some time past. The mine continues to make a favorable show.

Ripley has declined from 2¼ to 1¼ since our last, and there is little demand for the stock. At a special meeting of the shareholders, held June 19th, an assessment of $1 per share was laid, as below, and "upon payment of the first installment, due July 25th, there will be issued to stockholders of record of the 19th of June, one share of the eight thousand shares of the reserved stock of the Company, for every four shares held by them on that day, the said assessment of fifty cents being first paid upon such new issue."

The following assessments have been called for, and that of the Isle Royale is already due.

Companies.	Amount per share.	When payable.	Where payable.
Isle Royale,	$1	June 10.	Washington, D. C.
Humboldt .	$1	July 1.	Boston.
Toltec,	$1	July 6.	Boston.
Phœnix,	$1	July 10.	Boston.
Native,	50 cents.	July 15.	Boston.
Winthrop,	50 "	July 15.	Boston.
Bohemian,	50 "	July 25.	Philadelphia, Pa.
Ripley,	50 "	July 25.	Boston.
Ripley,	25 "	Sept. 25.	Boston.
Ripley,	25 "	Jan. 25, 1855.	Boston.

The Isle Royale assessment is also payable to Messrs. Head and Perkins, and that of the *Bohemian* to O. D. Ashley, Esq., transfer agent, Boston. *Phœnix* declined to 6, but is now in demand at that price. *Native* is heavy at 2, in consequence of the assessment of 50 cents, which will make the whole amount paid in $4.75 per share. The operations at the mine have been unsuccessful, but of late there are encouraging features which indicate that there is yet a fair prospect of successful development. *Bohemian* is heavy at about $8, and very little has been done in the stock here for some months.

There is great difficulty in selling, at anything like reasonable rates, the shares in new and undeveloped mines, most parties preferring to pay much higher rates for the stock in those Companies which have in a great degree proved their success. Many of the low-priced stocks are worthy of attention, however, and some of them will doubtless take higher rank within a year's time, and afford a very handsome profit on present prices.

The annual meeting of the *New England Copper Company* was held at the Treasurer's office, Boston, June 5th, and the list of officers elected will be found on another page of this Magazine. This is a new Company, the stock of which was subscribed for at $150 per share, but has not, as yet, been publicly sold in the market. The property of the Company consists of 439 acres of land, well timbered, and comprising fractional parts of sections 20, 29, and 30, township 58, north of range 27 west. It is the most eastern mine on the southern metalliferous range of Keweenaw Point, and has four well-defined veins, or rather concentrations of clusters of veins, besides others not yet sufficiently explored to describe accurately.

The Company have just commenced active operations under the superintendence of Mr. Edward Taylor, who considers it a choice selection of land for mining purposes. The mine is so near the coast that the expense of making roads, teaming supplies and copper, is avoided, as vessels can come directly to a pier, built, at a small expense, on the Company's premises.

William H. Stevens, Esq., has examined the different veins, and speaks very favorably of their general features, and is of the opinion that the property will pay well for systematic mining operations. The surface indications are very fine indeed; and if the future workings realize present indications, the mine will certainly become a paying concern at a moderate outlay of capital and within a reasonable length of time.

The fourth annual report of the *North Western Copper Company* has just been issued, and presents the prospects of the Company in a very favorable condition. The net receipts, from copper sold in 1853, was $11,229.63, against $1,831.94 for 1852, the first year of shipments; and now the yield has so much increased that it is hoped the mine will pay expenses after the present

year, and some of the more sanguine of its friends look for a dividend in 1855. An assessment of $2 per share was called in May 1st, which may be the last the Company will need, though it is possible that another will be deemed necessary to push forward the mine to a paying point at an earlier day, as the proceeds from copper sold cannot always be realized to advantage. There is everything to encourage the shareholders however, and their property is rapidly enhancing in value; more especially has this been the case within the past three or four months, during which time large masses of copper have been met with, one of them weighing not less than fifty tons, although the whole of it has not yet been uncovered. We have read the report of the Directors and Superintendent with much pleasure, and fully believe that the North Western is to become a first-class mine at a day not far distant.

The following table will give the variations of mining stocks for May, and, with some few exceptions, it will be noticed that prices are all lower than at the close of April. Pittsburg and North Western have made handsome gains, which are well sustained to this date. Transactions are light, and cannot be expected to increase during the coming summer months.

BOSTON MINING SHARE LIST.

Fluctuations for May, 1854, in thirty-one different Mining Stocks, sold at the Boston Stock and Exchange Board, showing their Highest and Lowest Points, and the Date, with the Market Value at the close of the Month, Gain or Loss for the Month, and number of Shares sold in each.

Mining Stocks, Boston.	Nominal Capital.	Shares.	Par.	Paid in June 30.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value May 31.	From April 29. Gain	From April 29. Loss	Shares sold in May.	Value June 30.
Adventure, *Copper.*	$250,000	10,000	25	$11.00	—	—	—	—	2¼	¼	—	No sale.	2
Algonah.....	500,000	20,000	25	1.87½	8½	25	2½	10	8½	—	¼	1,600	2½
Bay State	500,000	20,000	25	‡2.00	—	—	—	—	1	—	—	No sale.	1
Bohemian	250,000	16,666	15	4.44	8½	23	2	11	2½	—	1	450	2¼
Boston	500,000	20,000	25	‡2.00	—	—	—	—	1	—	0	No sale.	1
Copper Falls.....	800,000	10,000	80	18.00	64½	25	57½	6	61	3¾	—	194	58½
Dana.....	500,000	20,000	25	1.62½	1½	2	1½	23	1½	—	¾	200	½
Forest	200,000	10,000	20	15.00	12½	27	9½	9	12	1	—	2,025	10½
Fulton.....	500,000	100,000	5	‡2.00	1½	2	1	11	1½	—	¼	900	¾
Glen.....	500,000	20,000	25	‡2.00	—	—	—	—	1½	—	¼	No sale.	1½
Isle Royale.....	120,000	12,000	10	9.00	19	2	17	16	18½	8¾	—	520	†16½
Malone, *Sandstone.*	400,000	40,000	10	3.12½	†6¾	27	5⅝	3	6¾	⅛	—	400	6¾
Manassas, *Mining*..	1,000,000	100,000	10	‡2.00	—	—	—	—	¾	0	0	No sale.	¾
Manlton, *Copper*...	100,000	10,000	5	1.25	—	—	—	—	¾	0	0	No sale.	¾
Minnesota	800,000	8,000	100	22.00	170	17	170	17	170	0	0	2	180
National.....	250,000	10,000	25	8.00	—	—	—	—	23	—	2	No sale.	23
Native.....	250,000	10,000	25	4.25	3	24	3	24	2¾	—	⅛	25	2
North American....	800,000	10,000	80	21.50	—	—	—	—	70	—	5	No sale.	67
Norwich.....	100,000	20,000	5	5.00	—	—	—	—	9	—	1	No sale.	6
North Western.....	800,000	9,000	38½	14.67	20	24	20	24	22	6	—	5	24½
Phœnix.....	800,000	10,000	80	6.00	7¼	9	7	29	7	—	1	90	5¼
Pittsburg, (*Old*)...	.....	6,000	—	13.50	158½	31	137	3	158½	16½	0	22	150
Ridge	.....	10,000	—	6.50	—	—	—	29	6½	0	0	No sale.	6½
Ripley.....	500,000	40,000	12½	2.00	2½	9	2½	—	2½	—	⅛	1,400	1½
Shawmut.....	500,000	20,000	25	8.00	—	—	—	—	1½	—	¼	No sale.	1½
Star.....	500,000	20,000	25	8.50	—	—	—	—	6	0	0	No sale.	6½
Summit	500,000	40,000	12½	‡5.00	—	—	—	—	5	0	0	No sale.	5
Toltec.....	500,000	20,000	25	5.00	9	4	8½	30	8½	—	¾	3,140	5½
Winthrop.....	500,000	20,000	25	.75	2½	26	1½	8	2½	—	¼	1,175	1½
Webster.....	200,000	40,000	5	‡2.00	1½	2	1½	2	1½	—	¼	25	1
W. Castleton, *Slate*.	1,000,000	50,000	20	‡6.00	8½	3	8½	3	8	—	—	80	2½

† Assessment paid. ‡‡ These are fully paid stock, not assessable.

200 shares *Parker Vein Coal Co.* were sold, May 3d, at 5½, buyer thirty, and 300 shares, May 15, at 5½, buyer 10 days. 100 shares *Berkshire Glass Co.* sold, May 5th, at 8½, and 100 shares *Rockland Copper Co.*, May 4th, at $11.00 per share; these, together with the table, comprising all the sales of *Mining Stocks* in this market for the month of May.

NEW YORK METAL MARKET.

JUNE 20th, 1854.

COPPER, INGOT.

South America	per lb.	29c
United States	"	31c
Sheathing, 16 oz. and upwards	"	29½c
Braziers	"	35c
Old Sheathing	"	26c
New Bolts	"	35c
Wire, 10c per lb. additional to card prices brass wire per No. Tubing	"	45c
Copper ore 30 per cent. per ton		$120 to 150

Copper ores are sold per rate of yield, 30 per cent. ore is worth four to five dollars per one per cent. of yield.

Composition Sheathing ..... per lb. 26c

IRON.

Duty 30 per cent. ad val.

American Hammered Bars	per ton	$75a85
" Refined iron	"	85a90
English common iron	"	69a70
" Refined iron	"	80
Swedish Bars	"	90a92.50
Railroad Bars	"	77.50a80
American Sheet	per lb.	5½c
English " No 1 to 20	"	4½c
" " 21 to 24, incl.	"	5½c
" " 25 to 28	"	6½c
Russian "	"	13c
English Hoop	per cwt.	$4.75a5
Amer. "	"	4.75a5
Common Bloom	per ton	45a50
Good "	"	50a55
First q'lty "	"	55a58
Refined "	"	70a74

Galvanized, card price as follows:

No. 14	per lb.	10c
16 and 17	"	10½c
18 and 19	"	10½c
20	"	10½c
21, 22, 23, and 24	"	11½c
25	"	12½c
26	"	12½c
27 and 28	"	13½c
29	"	14½c

Net, 6 months' prices.

Scotch Pig. No. 1	per ton	$38a39
No. 1 American, No. 1 Brands	"	37a45
" 1 " No. 2 "	"	36a40

LEAD.

Spanish	per 100 lbs.	$6.50a6.56½
American	"	7 a7.12½
English	"	5.50a6.75
Bar	"	6.75
Sheet	"	7.25a7.50
Pipe	"	7.25a7.50

NAILS.

Cut 4da60d	per 100 lbs.	4½a4¾
Wrought 6da20d	"	8 a10

SPELTER.

Duty:—In Pigs, Bars, and Plates, 5; Sheets, 15 per cent. ad val.

Plates $5¼

STEEL.

Duty:—Cast, Shear, and German, in bars, 15; all others, 20 per cent. ad val.

English	per lb.	$16 a18
German Cast	"	13 a14
English Spring	"	6½a 7½
American Spring	"	5 a 5½
English Blister	"	9 a14
Common American Blister	"	4½a 5½
Milan, (in bond)	"	5½a 5½
Steel Cast—American	"	9 a16½
Steel Cast—Sheffield	"	16 a18
Hoop M N L	"	9 a14
Common English Blister	"	4 a 8c
Terne Plates—Coke	14x20 at	$9.25 cash.

TIN.

Banca	$30
Straits	29
English	—
Bar	—
Plates—IC Coke, cash	8a8½
" ½ X Charcoal	10a10.25

ZINC.

Duty:—In Pigs 5; in Sheets 15 per cent. ad val.

In Sheets ..... per lb. $8½a8½

LONDON METAL MARKET.

MAY 26th.

COPPER.

	£	s.	d.
South American	126	0	0–128

IRON.

Pig, No. 1, in Wales	4	10	0–	6	0	0
Bars, common, ditto	8	5	0–	8	10	0
Ditto, Swedish, in London	14	0	0–	14	10	0
Pig, No. 1, in Clyde	4	6	6–	4	7	0

LEAD.

English pig	24	10	0–		—	
Ditto sheet	25	10	0–		—	
Ditto white	28	10	0–29	0	0	
Ditto patent shot	27	0	0–27	10	0	
Spanish, in bond	23	10	0–24	0	0	
American	none.					

FOREIGN STEEL.

Swedish, in kegs	per ton	18	0	0–19	10	0
Quicksilver	per lb.	0	2	1		

SPELTER.

Foreign	per ton	22	17	6–23	0	0

TIN.

English, blocks	119	0	0–		—	
Ditto, Bars (in barrels)	120	0	0–		—	
Ditto, refined	122	0	0–		—	
Banca	120	0	0–124	0	0	
Straits	115	10	0–116	0	0	

TIN PLATES.*

IC Charcoal	per box.	1	18	0–1	14	0
IX Ditto	"	1	19	0–2	0	0
Canada plates	per ton	16	0	0		

In London, 20s. less at the works.

* At the works, 1s. to 1s. 6d. per box less. In Liverpool, 6d per box less.

JOURNAL OF GOLD MINING OPERATIONS.

DENSITY OF GOLD.

The density of a mass of California gold, weighing 2572·13 grains, was found to be 15·808. According to the mean of analysis, by Professor Thomson, California gold contains about 88¾ per cent. of gold. The density of gold brought from the rivers Khoten and Cashgar, India, was found to be 17·224. It consisted of 89·3 gold, 7·3 silver, 3·4 copper. African gold, with a density of 14·457, consists of gold 78·, copper 11·8, silver 9·48.

ALLOYS OF GOLD.

Gold in an alloyed state is said to be of so many carats. Pure gold is 24 carats, which is the unit in this mode of estimation. Each carat is divided into twelfths. Standard gold is 22 carat gold; or, in every 24 parts, 22 are gold, and 2 alloy; or, in every pound troy there are 22 carats or $\frac{11}{12}$ fine gold, and 2 carats or $\frac{1}{12}$ alloy. *Gold amalgam* is a combination of gold and mercury, for gilding metals. *Green gold*, used in jewelry, is an alloy of 30 silver and 70 gold. *Jewellers' standard gold* is 18 carat gold, or contains 75 per cent. gold, that is, three-fourths of its weight. Gold containing much copper is liable to tarnish, which, however, may be removed by immersion in ammonia and friction.

"PARTING," OR REFINING GOLD.

All native gold contains silver, and usually copper. To remove these the operation of parting is required. On page 168, Vol. I., Mining Magazine, is described a new method of refining gold. The process of parting may be performed with nitric acid, which dissolves the silver and copper, and leaves the gold. Owing to the expense of nitric acid, sulphuric acid is now usually substituted. It has long been used in India to separate the gold and silver in the Sycee silver of China. In parting, the alloy must not contain more than 20 per cent. of gold, nor 10 per cent. of copper. The best proportions for facility in parting are 72·5 per cent. silver, 20 gold, 7·5 copper. If more gold is present it may escape being acted on; and if more copper exists in the alloy, much anhydrous sulphate of copper surrounds the metal, and shields it from the action of the acid. The alloy being fused and granulated in water, is placed in a porcelain or cast-iron boiler, and covered with two or three times its weight of sulphuric acid, of specific gravity 1·848. The boiler is covered with a head which conducts into a draught, to remove the sulphurous acid formed. Heat is applied by a direct fire for from four to eight or twelve hours, till the solution is completed. The acid liquor is cooled, and drawn off into lead vessels, and the gold boiled with some fresh acid. But considerable variation occurs in this stage of the process; sometimes weaker fresh acid being added before the first acid solution is poured off. The gold is well washed, removed, and ignited in a black-lead crucible. From the solution the silver is reduced by the insertion of copper bars in it.

ASSAYING GOLD.

An assay of gold ore is not difficult. Methods of assaying it have been mentioned on page 416, Vol. II. It may be stated, in addition, that the ore, especially when much gangue is present, is mixed with a flux consisting of borax, alkaline carbonate, common salt, charcoal, and litharge, and fused in a clay crucible. Some object to adding common salt, except as a stratum

over the test in the crucible. The reduced metals are then cupelled with lead, when a button of gold and silver alloy alone remains, the litharge and copper having been oxidized, etc., etc. Gold is reduced from its solutions by protosulphate of iron, with the addition of a few drops of chlorohydric acid. Another method is to mix solutions of protochloride of tin and sesquichloride of iron until a pale green is formed, and then add the mixture to a solution of chloride of gold freed from nitric acid.

CALIFORNIA GOLD FIELDS.

The accounts received from the interior of the State show that the miners were never doing better than at present. Since the middle of January the weather has been propitious for their operations, sufficient rain having fallen to afford every facility for working, and at the same time at such intervals as not to render the roads impassable, or to any great extent to flood their claims. New discoveries of rich deposits are made every day. Recently new diggings have been opened on the head waters of Russian River, a stream which takes its rise in the coast range of mountains north of Napa, and empties into the ocean a little above Bodega. As yet they have not proved very rich; but the discovery of them establishes the general diffusion of gold throughout the whole of the coast range of mountains, as well as in the Sierra Nevada. The most startling discovery of gold, however, has been at Iowa Hill, in Placer county. Although only opened some few weeks, thousands of dollars have already been taken out. Gold has also been discovered at Los Angelos, at Santa Cruz, and in the coast range about twenty miles below San Francisco. The complete diffusion of it throughout the State is now considered as established. During the month of April there was shipped from San Francisco $4,363,968.20. During the same month last year $7,660,851.62. Leaving a balance against this year of $3,296,883.42. This falling off is not to be attributed to any decrease in the yield of the mines, which are notoriously producing more than they ever were before, but to the fact that the home crops are beginning to exercise an influence in the retention of gold in the country, and principally to the fact that the people are less in debt to the East at present than at the corresponding period of last year.

GEOLOGY OF THE GOLD REGION.

A paper was recently read before the London Geological Society, on this subject, by Mr. Wilson, a practical miner of some years' experience in California, of which the following is a brief summary:—

The Sierra Nevada is of granite, and rises to the height of about 5,000 feet above the sea; it is flanked on the west by parallel bands of schistose crystalline rocks (gneiss, limestone, and micaceous, chloritic, and argillaceous slates), striking northwest and southeast; nearly vertical close to the granite, and dipping somewhat to the east in the outer parallels. A fossil shell, like an orthis, was found in the chloritic slate. These rocks form a tract about 50 miles in breadth, and averaging about 4,000 feet in elevation above the sea. It is traversed by three great veins of auriferous quartz, parallel to the schists and to each other. Between this district and the coast are wide plains of tertiary deposits, extending on either side of the coast range, which runs in a direction parallel to the coast and the Sierra. The coast range is about 2,500 feet high, and is formed of clay slate, with a westerly dip. The clays, gravels, and boulder-beds, in the ravines and plains of the high ground, which is traversed by the above-mentioned quartz veins, contain gold more or less abundantly, and appear to have been formed, under various conditions, by superficial decomposition of the rocks, by land-slips, and by detrition and transport through aqueous agency. Calcareous deposits, also, of late tertiary date, cov-

ering the gold drift, embedding boulders and sand, and in the upper part commingled with volcanic cinders, occur extensively in some of the valleys, and on the sides of the hills of this elevated region.

The largest of the three quartz veins has itself been worked for gold, at Carson's Hill, at the Mariposa River, and the Agua Fria; and another of the veins at Sonora. The gold was found in the upper part of the veins—a circumstance which the author found to obtain in the quartz veins generally. Quartz mining, however, on account of the uppermost and richest portions of the veins having already been decomposed and worn away, is not found to be so productive as the generality of the "diggings." Mr. Wilson describes several of the gold diggings of the district; especially near Sonora; on the Rivers Stanilaus and Tolumnee; and at Mormon's, Curtis's, and Murphy's Creeks, etc.; and he pointed out the peculiarities of "river diggings," "flat diggings," and "dry diggings."

The search for gold in the beds of the existing rivers has, with few exceptions, proved to be unsuccessful in California.

Mr. Wilson described also in detail the porphyry of Table Mountain, the greenstone vein near Sullivan's Camp, the caves in the tertiary limestone at Coyote Creek, and the cinnabar mines in the clay slate, with quartz veins, of the coast range.

QUARTZ MINING.

In Calaveras county quartz mining is reported to be very successful. It is stated that there is not now a single quartz mill which does not pay a good interest upon the capital invested, and some of the mills on and in the neighborhood of Amadore Creek are producing princely fortunes. For instance, the Rancheria Mill has lately produced, in eighteen days, $3,775—the expense of running could not have exceeded $1,200. The Spring Hill Mill, over $3,000 in fifteen days, at an expense of probably $700. The Keystone Mill, $3,000 in twelve days, at an expense of probably $1,000. These mills all use stamps and shaking tables with quicksilver. The Phœnix Mill, on the South Fork of the Moquelumne, one of the best mills in the county, has lately been running with an average profit equal to the above, but is now inoperative and in the market. The mine is said to be one of the richest in the State, paying equally at all points, and is well opened. Quartz mining is of late attracting a good deal of attention, and we do not doubt that this county is as rich in this department of mining as any in the State.

CANAL COMPANIES.

Few if any of the canals in the State are more extensive, or are said to offer better inducements for investment than Jones' at Diamond Springs—for if the placers should be exhausted, the sale of the water for manufacturing and agricultural purposes will pay a large per centage on the original outlay. The main canal and its lateral branches extend already over fifty miles, through a very rich mineral region; and other branches, that will soon be completed, will extend it some ten or fifteen miles further. Without the water thus conveyed through these lands, the mines would be comparatively valueless. These canals have made Diamond Springs what it is—one of the most flourishing and thriving towns in the State. Their receipts must reach nearly $3,000 a week.

Rock Creek Canal.—This has been one of the most profitable works, and is now paying, it is said, better than any other in the State. Its entire length is about sixteen miles. It supplies the miners of American Flat, Spanish Flat, Stag Flat, Louisville and Kelsey's—immensely rich mining localities—with an abundance of water. Its construction cost the Company about $60,000, which has all been paid out of the receipts of the Company,

with the exception of $11,000. The receipts of the Company are from $1,500 to $2,000 per week.

The Calaveras Slide.—About two years ago, says the *Chronicle*, a party of men were at work cutting a tunnel near one of the branches of the Calaveras, and having expended about three months' labor upon it, had got tolerably far into the bowels of the earth, when one night as they were in bed, dreaming doubtless of the glittering piles to be realized by their operations, they were suddenly awakened by a tremendous crash, and emerging from their cabins which were in the vicinity of their work, they discovered their tunnel in ruins, and all their golden visions thus ruthlessly dissipated. The labor of months was rendered useless in a moment. Morning came, the ruins were examined, a consultation held, the season was too far advanced to renew operations, and folding up their tents, the miners quietly vanished away. Thus has the slide remained until lately, when water being introduced, facilities for ground sluicing became available, the hose was applied, the surface worked off, the picks and shovels of the former party discovered, and finally the rich deposits arrived at. The result has been, that within a month or so, from eight to ten thousand dollars have been washed out of this claim. It is one of the richest deposits in the country.

PLACER DIGGINGS.

Iowa Hill.—The *State Journal* says the excitement concerning the new diggings discovered at this locality continues unabated. Of course, due allowance must be made for exaggeration; for it is well known that when new diggings are discovered, there are always interested parties whose business it is to secure as large an influx of consumers as possible: and hence the poor miner, unless he make the necessary allowance, is sure to be deluded to a greater or less extent. We have conversed with parties who have been at Iowa Hill since the reported discovery of gold in unusual abundance, and have been constrained to believe that there has been perhaps as little exaggeration as is customary in similar cases; and, with this allowance, the diggings are doubtless as rich as any that have been discovered in California within the past two or three years. Iowa Hill is twenty-four miles from Grass Valley, by stage.

Russian River Mines.—The lately discovered mines on Russian River appear to have created considerable excitement in that neighborhood, though evidences of success are not at all plenty. The extent of the country through which gold is said to exist, comprises about sixty miles upon that river and its tributaries, Dry Creek, Mill Creek, etc. A place on the former river, called Fitch's Crossing, is laid down as the lower boundary of the gold region. Parties who have visited these diggings confirm the report that gold is found; but as yet little more than prospecting has been done. The whole question of whether these mines will pay at present, or not, yet remains to be determined.

Success of the Miners in Tuolumne.—The *Sonora Herald*, of Sonora, gives the following cheering account of the success of the miners in Tuolumne. The miners generally are making better wages than they have done for a long time past. This is not to be accounted for by the stale, worn-out cry of "new diggings," or by any long, and perhaps fabulous tale of rich discoveries having been made; but by the simple fact that the rain has almost, if not entirely, ceased for the summer, leaving plenty of water in the rivers to supply the various ditches with water to be taken on to the flats and gulches, where it never could otherwise be had, and not enough in the creeks to interfere with the majority of the mining operations on them. We have authentic information that the miners in the neighborhood of Mormon Gulch, Tuttletown, Shaw's Flat, Springfield, and other places, are reaping a rich reward for their labor; and we feel assured that wherever, in Tuolumne county at least, a like amount of industry and energy is displayed, a like result will follow.

We are also informed that, at Jamestown and Chinese Camp, the miners are doing extremely well, and that at the latter place they are doing better than at any former period. On Sonora, Wood's and Sullivan's Creeks, a greater number of miners are doing well, though the accounts which we have received are not as encouraging as from the first-mentioned places. We shall ere long take an opportunity to see for ourselves, and shall report accordingly.

Gold Mines in the Coast Range.—Rich deposits of gold have recently been discovered in the coast range of mountains east of San Jose Valley, about 15 miles distant from the Mission of San Jose.

The placers were discovered in a narrow valley, through which a stream of water runs, which is reached after crossing the third range of mountains in the chain which divides the Valley of San Jose and San Joaquin.

We are informed that hundreds have already assembled at the gold deposits, and that stores and boarding-houses are being constructed for the accommodation of the miners. The operators are taking out from ten to fifteen dollars per day to the hand.

Several parties from Santa Clara county have gone to the placers. A gentleman who left the diggings on Monday estimated the number of persons on the ground at between 500 and 800, and the average yield at $8 per day. Since then many more hundreds have gone to the gold fields. It is said that the deposits are situated upon a creek which flows down a valley in the mountains, and are about due east from the Hot Springs.

"*The Mines are Worked Out.*"—In support of this proposition *The Mariposa Chronicle*, of May 15th, says: We were shown on Wednesday last a piece of yellowish-looking metal, weighing 11 oz., and $5, which, together with about 3 oz. of fine gold, was taken out in one day from the claim of Messrs. Broadhead, Crippin & Westfall, on the Mariposa. The lump is nearly two inches square, and about three-eighths of an inch at its thickest part, and contains not a particle of quartz. This is not the only lump ever found in this particular neighborhood, as the following, found during the last two or three months within a mile of Mariposa, will testify:

One lump of 52 ounces; one of 50 ounces and $1; one of quartz and gold, which contained 147 ounces of gold; another of quartz and gold, weighing 192 lbs., containing about 180 ounces; besides smaller ones of 12 ounces and less, too numerous to mention.

The mines are worked out—entirely exhausted—of course they are.

AUSTRALIAN GOLD FIELDS.

The dates from Australia are a month later than our previous accounts. The reports are quite favorable, containing the following almost incredible statement of a monster nugget:—

Eureka is still maintaining its high character, several heavy finds having been recently reported, among which is a nugget weighing 540 oz. Another party is said to have netted 405 lbs. weight, without requiring to wash a single tub. The Wardy Yullock is reported as turning out favorably. Altogether, the appearance of the fields on the Ballarat side affords reason to expect a prosperous season. The escorts have brought from

	Ounces.
Mount Alexander and Bendigo, ...	17,880
Ballarat, including Geelong, ...	9,609
M'Ivor, ...	564
Amount for the week, ending Feb. 19, . . .	28,053
Addition for the year, 184,564 oz.	
Gold shipped in 1854, ...	199,057
Per *Australian* (steamer) to London, ...	78,907
	277,964

Or 11 tons 11 cwts. 2 qrs. 18 lbs. 8 oz., at 75s.—£1,042,305.

The following letter, dated Ballarat, in February, is copied from the *Melbourne Argus:* "The celebrated 'monster nugget,' upon the fruits of which the lucky finders are now probably enjoying their *otium cum dignitate* in Old England, and which gained for them an interview with that sovereign whose profile is now probably impressed on the greater part of the fruits of their labor, hardly created a greater sensation than that produced on these diggings on Tuesday last. In an old hole, situated in a part of the old Eureka, and opposite Messrs. Hassel and Monckton's London store, a place now almost totally deserted, there was found by Thomas Cordwant, William Smith, and a party of five others, a nugget weighing 52 lbs. 1 oz. Strange coincidence! The other 'monster' was also found in a deserted hole. This nugget is 9 inches long, by about 7 inches broad, has a striking resemblance to a tortoise, and is composed of smooth gold, almost wholly unmixed with quartz. So strange is it that one should go to bed poor, and proceed to the commissioner's a comparatively rich man in the morning. But the Eureka is not alone at present famous for nuggets. A general inspection of several tubs on the Eureka yesterday gave me ocular demonstration of the immense richness of the 'dust' got from the stuff of this famous line."

New gold diggings have been discovered at Tambaroora and Major's Creek. Both places are near to Sydney, and are turning out well. Upwards of 500 licenses have been issued in the month. In one day 3½ oz. were taken out in one prospect. The diggers are working in good spirits, although they labor under the disadvantage of a scarcity of water, and in parts the sinking is very deep. The accounts of the new gold field at Campbell's Hill, near Bathurst, have been confirmed by the last escort. All the people at Bathurst are flocking there. They report it as being rich on the surface. The gold is similar to the Bendigo. One digger, two days absent from Bathurst, returned with 20 ounces. It appears the discovery was made by men reaping. A party of three on Spring Creek divided £1,500 for six weeks' work. The small knot of diggers at Adelong have sent down 300 oz. From the Turon, success still attends the few who have remained; and from Ophir it is stated that a party had taken out a large amount.

The new diggings on Major's Creek are turning out even better than the most sanguine could have anticipated, and the success that has attended many is most cheering. There are about 1000 persons at the diggings, and 700 at work. A party of four, the first week in February, took upward of 40 ounces of gold out in the week, being an average each man of £36 10*s*. Another party of ten are taking out their 12 ounces per day.

By the last accounts from the Ovens it is certain that the Buckland Ranges will prove very productive. A great number had left the Ovens for this side. Ballarat still brings forth its wonderful and gigantic yields of gold from deep sinking; 130 feet deep four men picked out with their knives, in less than 48 hours, 460 pounds' weight; the second party 200 pounds' weight. Besides the immense quantity stated of washing stuff, a nugget has been taken out weighing 150 lbs. It clearly shows that the theory of gold digging is completely upset. Until California was discovered, and the perseverance of the miners, these wonderful deposits would never have been brought to light from such immense depths.

GEOLOGY OF THE VICINITY OF MOUNT ALEXANDER.

The following is a summary of a paper read before the London Geological Society by A. Selwyn:—

Mount Alexander forms part of a granite range, which extends from the River Coliban on the east to the Loddon on the west, with a breadth varying from four to twelve miles, and describing an irregular semicircle, the convexity being to the north. The granite is bounded on all sides by metamorphic rocks, and at its eastern extremity it is overlaid by patches of basaltic lava,

among which the Coliban runs. The basalt occurs also to the east of the Coliban in still greater extent, overlying the metamorphic rocks along the course of the Campaspe. At the western limit of the granite, also, similar basalt forms the lava plains of the Loddon.

The granite is coarse-grained, and easily decomposes; it has a spheroidal structure, and is traversed by north and south and east and west joints, and it is penetrated by numerous fine-grained granitic elvans. The granite appears to be barren of metals, and has no quartz veins.

The metamorphic rocks consist of sandstones, clay-slates, and conglomerates, striking every where true north and south, and dipping east and west, at angles varying from 45° to 90°. The strata become more crystalline and micaceous in the immediate vicinity of the granite. The whole mass of the sandstones, slates, etc., is traversed by an intense north and south *cleavage*, as well as by a system of large joints, both north and south (generally at right angles, or in an opposite direction to the cleavage planes), and east and west. The *stratification* is obscure, but generally coincides in strike with the cleavage, but dips at a somewhat lower angle. Coincident with the cleavage, both in strike and dip, are numerous quartz veins throughout the strata. These veins contain gold, galena, blende, and ores of iron; platina, also, is said to occur in them. The metamorphic rocks have not as yet afforded any fossils; but Mr. Selwyn considers it probable, from their lithological characters, that they may be the equivalents of the Cambrian or Lower Silurian strata. Their total thickness in this district is about 35,000 feet.

The basalt resting on the granite and the slate-rocks is vesicular, and is evidently the remains of vast lava streams that have flowed down and filled up the then existing valleys of the country: the present river-courses have been subsequently excavated through the hardened lava along the same valleys. Some of these excavations expose the lava and the subjacent rock in vertical cliffs, from 200 to 300 feet high. The auriferous drift overlies all the surface formed by the metamorphic rocks. It is of very late tertiary date; it varies in thickness from a few inches to 100 feet and upwards, and consists of stratified and unstratified masses of ferruginous clays, sands, and gravels, interspersed with angular and partially rounded fragments of clay-slate, sandstone, quartz, etc. The gold is usually found in the lowest portion of the drift, and has been derived from the quartz-veins every where traversing the metamorphic strata. The drift occurs almost universally distributed in the gullies, on the flats, and over the hills, occupied by the metamorphic rocks; and is, in fact, formed from the decomposition, breaking up, and spreading out of the immediately subjacent rock; the fragments are seldom much water-worn.

GOLD IN GEORGIA.

From a private letter the *Dahlonega Signal* learns that a valuable discovery of gold and copper has recently been made near Allatoona, upon what is familiarly known as Dr. Bacon Mine, from the fact of his having once operated upon the same for gold. The following is an extract:—

The mine is very rich for gold, and interspersed through a six feet vein with copper; we, at a depth of ten feet, have taken out a quantity of beautiful No. 1 copper ore. The vein dips east, about 45 degrees; it is regular in its formation, and increases in richness as we go down it. The mine lays east of this place about five miles, near the Alabama road, in the neighborhood of Geo. Raney's, Esq.

All we need in this country to make Georgia a copper country, is men who will invest the capital to develop them.

The same authority says:—We learn through Dr. Bacon, Superintendent of the New York Mining Company, located near this place that they have re-

cently opened three veins on their lot of extraordinary richness. The veins are large and easily pulverized. The Company are progressing rapidly with their works, and getting out a quantity of ore. Dr. Bacon has recently visited the gold mines of North Carolina, and assures us that the mines of Lumpkin will compare favorably with those of our sister State.

GOLD IN NEW GRENADA.

The following interesting particulars relative to the region around Quibdó, in New Grenada, are reported by Mr. J. C. Trautwine, Civil Engineer, in a sketch of an exploration for an interoceanic canal route. Some particulars respecting the gold of New Grenada are stated in Vol. I., page 284:—

Quibdó is the emporium of foreign merchandise for a great extent of very sparsely populated territory. It is all procured from Carthagena, and some idea of its limited amount may be formed, from the fact, that its transportation requires but about one boat of from twenty to thirty tons burden, monthly. The average value of the cargoes usually ranges between $2,500 and $5,000; so that $50,000 may be considered a liberal estimate for the amount of foreign merchandise annually consumed in Quibdó, and the adjacent region. The great bulk of the articles is of inferior quality, adapted to the necessities and primitive tastes of the poor and semi-civilized negroes and Indians, among whom it is distributed.

Of these, the former generally pay for their purchases in gold dust, and the latter in the produce of their little "rosas," or patches of cultivated ground. The Indians here are strongly averse to searching for gold, probably a consequence of their traditional sense of the horrid barbarities which its possession entailed upon their ancestors at the time of the Spanish conquests. They conceal all knowledge of rich localities, and even take the trouble to obliterate evidences of their existence, when it is in their power to do so. The blacks, not being burdened with such disagreeable reminiscences, have no scruples in hunting for gold; indeed, it constitutes the principal active occupation of the greater proportion of them; many are refugees from justice from every part of the republic, who find a secure retreat from pursuit in the fastnesses of the forest-covered mountains, in the defiles of which their searches are conducted.

It is needless to remark that their operations are carried on without the aid of science or system. Each one hunts for himself, and a calabash or wooden bowl comprises the inventory of his machinery. Aiming at nothing more than barely to supply the absolute necessaries of his vagabond existence, (which exact but few more appliances than those possessed by the beasts of the forest,) it may well be imagined that his exertions are light, and their result correspondingly insignificant. Still, Dr. Key informed me that in consequence of the numbers employed in this avocation, the gold dust annually brought into Quibdó, amounted in value to about $200,000. It is carried to the stores in very small quantities, frequently tied up in a leaf by the tendril of a vine. Thus gradually accumulated, it constitutes almost the sole medium of payment for the merchandise purchased in Carthagena.

The store-keepers are careful to apprise the gold hunters of its real value, as estimated in coin. By this means strangers are prevented from making great bargains in the precious commodity, as they would have to pay for it very nearly its actual value; whereas, the store-keepers themselves obtain it in barter for their goods, upon which they fix prices "ad libitum."

Beside the articles of foreign importation which are carried from Carthagena to Quibdó, such as textile fabrics, groceries, crockery, etc., there are some provisions of home production, such as yams, rice, cheese, jerked beef, &c. Paucity of population, combined with indisposition to labor, prevent these from being raised in the immediate vicinity in quantities sufficient to

supply the demand arising from 1500 stomachs. There is no cultivation whatever immediately contiguous to the town, but the supplies of such articles of food as the natives raise are brought from the little rosas prepared along the levees of the Atrato and its branches, for many leagues around; and even from the valleys of the Cauca, Baudó and San Juan.

From the immense extent of country in which gold here exists in large quantities, in combination with the inducements offered to immigrants by the government of New Granada, I cannot doubt that when the lapse of a few years shall have served more fully to extend the knowledge of these facts, an excitement and influx of foreigners to the slopes of the western Cordilleras, will take place, exceeding even those attendant on the discoveries in California and Australia.

Here, not only gold, but platina abounds; and in sections of the republic more to the eastward, mines of silver and copper have for a long time been profitably worked. Most of the platina is, at present, derived from the vicinities of San Pablo, Nóvita, and Loró. Near Bogotá, (the seat of government of the republic,) are the celebrated emerald mines of Mussa, and no doubt can exist that when the country shall have been subjected to a proper geological examination, mineral treasures will be found as richly disseminated as in any known part of the earth.

There is no reason, whatever, to doubt that an almost uninterruped deposit of the precious metals extends through the entire western portion of both Americas. from the extreme north to the extreme south.

Perhaps the chief, if not the only, extensive interruption of this great deposit, will be found to be where the igneous rocks of the Cordilleras are replaced by the slightly elevated transition formations that occupy the region comprised between the Carribbean Sea on the northeast, and the Pacific Ocean on the southwest, and through which flow the rivers Guácuba, Atrato, and San Juan.

Through this region, there appears to me to be indisputable proofs that the waters of the Pacific and Atlantic were united at no very distant geological period. The only rock I saw in place between the Gulf of Urabá, and the Pacific at Buenaventura, was a gray tertiary sandstone, of various degrees of induration, from that of merely semi-indurated arenaceous clay, up to hard, perfectly formed stone. In every instance it contained fossil shells. I met with it at both the points at which I crossed the partition ridge between the Atrato and the Pacific, as in all the low parallel lines of hills which I have represented on the map, as bordering the Pató, the Baudó, the Surúcco, and the San Juan. The same rock is found at the same ridge in crossing from the Napipi to Cupica.

Gold has, I believe, been nowhere found to the west of this transition ridge of partition; but to the east of it, from below the latitude of San Pablo, it everywhere occurs in the diluvial gravel up to the very foot of the ridge. Near the head of the Surúcco I saw negroes washing rich gold-gravel at an elevation of some thirty feet above the level of the stream. These I conceive to be incontestible proofs that the gold-bearing diluvium has been spread over this region at a period subsequent to that of the elevation of this ridge. If so, it is inferable that the western Cordilleras, themselves, have undergone, at least a partial upheave since the elevation of the partition ridge. as otherwise it would be difficult to suggest a tenable theory for the dispersion of the diluvium.

Dr. Halsted, who had visited some of the gold regions of California, pronounced this spot on the Surúcco to be as rich as any he had ever seen, although it was near the extreme western limit of the auriferous diluvium, and consequently the farthest removed from the original place of deposit.

TREATMENT OF GOLD BY MERCURY.

In the principal gold reduction works in the Brazils, Chili, Peru, etc., the most common method to obtain it is by stamping and washing. In the Tyrol, however, small quantities of gold are extracted, by amalgamation, from an auriferous iron pyrites, the operation being performed in a sort of mill, of simple construction. It consists of a flat-bottomed conical basin, the upper diameter being the largest, somewhat resembling in shape a dairy-pan for milk, securely screwed down to a strong wooden table. It has a tube in the centre, for a rotating-shaft to pass through, to which is affixed a frame carrying a muller, which nearly fits into the annular space, and made hollow, sloping towards the centre. The pyrites having been first reduced to a fine powder, is introduced into the first of a series of these basins, in all of which a certain portion of mercury has been placed, and the mullers being set in motion, and a stream of water turned on, the mercury takes up the films of gold, and the debris is carried into the next mill, when any gold which may have escaped the first, will probably be taken up in the second; at all events, by the time it has passed five or six of these mills, not a particle will remain in the debris carried away by the water. These mills are allowed to work five or six weeks consecutively, when the mercury is drawn off, filtered through chamois leather, and the amalgam separated.

TREATMENT OF ARSENICAL ORE OF GOLD.

Two chief constituents, arsenic and sulphur, having an affinity for gold, will, if in considerable proportion, form a close combination with the gold; but if the iron be predominant, then the combinations will be simply mechanical, and the gold will be in a metallic and malleable state. Supposing, however, it is requisite to treat the gold in the other conditions, slow decomposition would seem to be one of the most efficient methods that would suggest itself, as thereby the iron would be oxidized, and a direct precipitation of the gold would be caused to take place, in consequence of the iron in its altered state becoming an opposite. Supposing the arsenic could be first got rid of without volatilising the gold, then this method would do very well; but there are two difficulties to contend with—namely, first, gold being very sensitive to electric action, the decomposition of the ore might be violent, and a portion of the gold would be thrown off, and unless there were a proper electric medium to receive it, and to hold it, it would be lost. Under geological conditions, the cold ferruginous clays, resting on the clay-slates, constitute Nature's medium for these various stages, promoting the formation of nuggets, and aggregations of pure gold. The second difficulty is, that the gold would be more likely to fly to the arsenic, having an affinity for it, and a less proportion, if any, would precipitate with the oxidizing iron. By taking advantage of these conditions, I have succeeded in inventing a process in which arsenic forms one of the principal agents in the extraction of gold from certain ores, and which I hope, at an early period, to bring into operation at my own reduction and smelting works.—*Corresp. London M. Jour.*

ON FORMING VESSELS OF GOLD BY THE AID OF PHOSPHORUS.

The property of phosphorus, of precipitating certain metals from their solution, has long been known; and gold is among the number. M. Levol has used this process in forming gold vessels, so useful in chemical research. He takes the perchloride of gold, and places in it, at the ordinary temperature, some phosphorus, moulded of a form convenient to serve as a nucleus for the vessel of gold. To give the phosphorus the desired shape, it is melted in a water bath near 60° C. in temperature, within a vessel of glass having the form required. After cooling it, the phosphorus is taken out solid from its envelope, breaking it if it be necessary. The precipitation of the gold or the

construction of the vessel is then begun; and it finally remains only to remove the phosphorus by re-melting it and washing, by the aid of boiling nitric acid, until the last traces are removed.—*Silliman's Journal.*

TO MAKE OXIDE OF GOLD.

Figuier, who tested the several methods of preparing this oxide, now so extensively used in electro-gilding, has determined the best to be as follows:—Dissolve 1 pt. gold in 4 pts. aqua regia, evaporate to dryness, re-dissolve in water, add a little aqua regia to take up the traces of metallic gold and of protochloride remaining undissolved. Evaporate again, re-dissolve in water, and mix with pure potassa perfectly free from chloride, until it gives an alkaline re-action with turmeric paper. Turbidity immediately ensues, when it is mixed with chloride of barium; aurate of baryta precipitates as a yellow powder. When the precipitate begins to assume a whitish appearance, the addition of chloride of barium must be discontinued, as all the gold oxide has gone down and the alkali commenced to act upon the baryta of the chloride. The aurate of baryta is then to be washed until the waste-waters cease to be precipitated by sulphuric acid. The aurate is then heated to boiling, with dilute nitric acid, in order to eliminate the oxide of gold. By washing until the water no longer reddens litmus paper, the oxide becomes pure, and must be dried between the folds of bibulous paper by exposure to air.—*Journ. de Pharm.*

JOURNAL OF COPPER MINING OPERATIONS.

LAKE SUPERIOR REGION.

The reports from the Lake Superior mines represent a state of unusual activity. The prospects of the year are more favorable than ever before, and the most sanguine expectations are entertained. The first shipments of copper were made about the middle of May.

We present some further particulars of the progress of work in some of the mines:—

Isle Royale Mine.—Since our last notice of this mine, on page 558, Vol. II., the work has advanced as follows:—

North drift, No. 3 shaft, first level, is nearly through to No. 2 shaft, and the head and sides of the drift are well studded with prongs of copper. S. drift, second level, is also carrying copper, as well as both drifts on second level No. 4 shaft. No. 3 shaft, second level, is also very rich in copper. Third drift, No. 3 shaft, is carrying some copper, and, from the appearances of the vein materials, is good.

We must be enabled to raise a large amount of copper as soon as we commence stoping. We shall have Nos. 3 and 4 shafts, second level, connected, also Nos. 2 and 3, first level.

Toltec Mine.—This mine, last reported on page 675, Vol. II., has been advanced as follows:—

Shaft No. 4 is being sunk to the second level, and the vein is about 18 inches thick, but not rich. Drift E. of No. 4 is about the same. Winze No. 3 is being sunk to second level, and when commenced there was but a small vein; at the depth of thirty feet we have a vein over two feet thick, well charged with barrel and stamp copper, and it cannot be taken down. Stope

E. of No. 8, the vein is being taken down, and is over three feet thick, well charged with stamp work—a mass of nearly a ton weight has been taken down. In the bottom of shaft No. 3, the vein is about two feet thick, with chunks of copper striking out. Drifts E. and W. of this shaft, on second level, are looking splendidly. The vein is over two and a half feet thick, standing along in drifts, and cannot be taken down. In numerous places we attempted to bore into the vein, but could not on account of the copper. In backs of stopes No. 3, on first level, to No. 2 shaft, the vein will average two and a half feet in thickness, well charged with small masses, barrel and stamp copper. A mass was taken down a few days since, over winze No. 5, more than 1½ ton weight, besides a large quantity of barrel and stamp copper. Winze No. 2 is being sunk in second level, and the vein is about two feet thick, carrying barrel and stamp copper. Drift W. of winze No. 1, second level, is looking well, with a large vein, and to all appearances very rich in stamp work.

Algomah Mine.—To the statements on page 675, Vol. II., we add the following facts:—

Shaft No. 1 is 78 feet deep, and the vein from two to six feet in thickness, very rich in stamp copper, with considerable barrel work. Shaft No. 2 is 40 feet deep, with a large vein, but not rich.

Copper Falls Mine.—To the extensive report of Mr. Hill, on page 662, Vol. II., we have the following additional particulars:—

The Hill Mine never looked so well as at this time. In the adit south from shaft No. 5, we have a large bundle of masses of copper in a very large vein. In the stopes westerly, same shaft, and in the ash bed, we have masses of half a ton and one ton each. From this point of the work we have taken out some good masses. The surface about shaft 485 is covered with masses ready to go to the lake, as soon as the roads will admit of being travelled. South of shaft No. 4, and in the back of the adit, we are stoping alongside of good masses. South of shaft No. 6 we have small masses in the level above the adit. About shafts 4 and 5 we have nearly 1000 tons of stamp work, with some barrel work intermixed, which has been taken out of the mine during the past six weeks. We have just got fairly to stoping in the Copper Falls Mine, and the lode looks *well*. Stamp and barrel work are being daily taken out, and the level above the adit has been opened to shaft No. 6. In about six days more we shall set twelve men at drifting in the ash bed. We have been making examinations of late, and find that some parts of it produce 5 per cent. of copper. I know that we can stope many thousand cubic fathoms from that level, which will pay a great profit. In a cubic fathom there are 216 cubic feet; 200 lbs. to the cubic foot gives 43,200 lbs. to the cubic fathom, estimated to be worth two per cent., and we get 864 lbs. of copper to the cubic fathom. We can mine, land to the surface, stamp, and work a cubic fathom of that rock for $55. I wish to be cautious of giving room for any extravagant opinions of the value of this bed for purposes of mining; but I know we can mine some parts of it profitably, if not the most of it. Our stamps are all ready, and they have run one day. They are the best in the United States, and it is said by some of our *Cornwall* friends, who are in the country, that they are the best they ever saw in England. The washing-floors are being put in readiness as fast as possible, and on the 1st of May washing will commence. A large amount of stamp copper is now on hand, and it will take at least 24 heads of stamps more (although 24 are now in operation) to clear the stamp work in eight months.

A later report than the above states the following:—

The lode in the gallery S., of shaft No. 6, is large and well filled with copper. In the adit gallery S., of shaft No. 1, the vein has been small; it is now

becoming of good width, and well filled with copper. The stopes in this mine are turning out a great amount of stamp and barrel work. The east and west metalliferous bed is turning out copper well, and we are getting out more stamp work than we know what to do with. The lode in the levels is large and rich. The stopes are turning out a great deal of copper. We have some fine masses in sight, and more will be met with, I have no doubt, in a few days. The discovery of masses in our mine is getting to be an every-day occurrence. Our stamps are working very well; we have been running about two weeks; only a part of what has been stamped has been washed, and on Saturday we barrelled up three tons of copper from that work. Our roads have been so bad for a few weeks past, that we could do but little at hauling away copper. We now have ten tons at the harbor; to-day we have commenced hauling again, and will have by the end of the week twenty tons at the harbor. We now have in masses, ready to go forward to the lake, over thirty tons, and I think we shall be able to keep our team on the road with copper from this time forward. We must and can do a fine business this season at shipping copper, and in the year 1855 I do not expect we shall be very far behind the best mines in this country in the shipments of copper.

Phœnix Mine.—This mine was last noticed on page 675, Vol. II. The appearances as the work progresses are thus reported:—

The prospects of our mine have continued to improve ever since my last of April 15. In No. 6 shaft, the vein, as we sink upon it, improves in width, strength, and appearance, and the copper is very bright and healthy, mostly of a character suitable for barrelling, some of the pieces weighing 8 lbs. Mr. Hill, who is stopping here for a day or two, considers the show a very favorable one, and should the vein hold as good for any considerable distance it can be speedily made to pay. Recent openings to the south of our workings upon the E. vein confirm us in the belief that we have not been mistaken in regard to the wealth of the E. vein mine.

Native Copper Mine.—We add the following facts to those heretofore mentioned on page 555, Vol. II.:—

A new vein has been opened about 300 feet west of the old vein, and the level driven in 41 feet, with a mass of copper standing in the bottom of the level *for about sixteen feet.* We have stoped away the bottom of the level, at one end of the mass, about three feet; it continues. I shall ascertain how large the mass is as soon as possible, in order to arrange the work, and will tell you more in a short time.

North American Mine.—The last report of this mine is to be found on page 557, Vol. II. As it advances, the prospect is quite flattering:—

The North American has been sunk to its third level, and the galleries are being carried forward north and south. At this depth some very fine masses are exposed, the extent of which cannot for some time be determined. The mine bears evidence of richness, equal to the expectations of the Company. There are between twenty and thirty masses from this mine, at the landing at Eagle River, which will reach an average weight of two and a half tons each. The Fulton is looking very well, and is producing mass, barrel, and stamp copper.

The North-Western Mine.—To the report on page 556, Vol. II., we add the following:—

The North-Western Mine seems to take the lead in making extraordinary developments this spring. A mass in a stope has been stripped thirty feet in length and twenty feet in depth, with appearances of continuing in length and depth. This is encouraging news to the stockholders, and will place the price of their stock at a figure much above its present quotation.

Meadow Mine.—The Meadow mine is looking very promising, having a very rich vein upon which a drift has been driven about three hundred and seventy feet. Two shafts have been carried down, one of which has reached a depth of eighty-one feet from the surface. The vein, the whole distance, in the shafts and drift, is filled with small mass, barrel, and stamp copper. The Company employ twenty-four men.

Evergreen Bluff Mine.—The Company are pushing their work vigorously. They have, within the last month, erected a building twenty feet by fifty, and one story and a half high, for the accommodation of the men and miners now upon the work. When the crops are in, the whole force will be employed in mining. Surface men are very scarce. The mine looks well. The last work done has exposed to view a mass of copper in breast of drift. The drift is now in one hundred and twenty feet and eight inches.

Empire Mine.—Later reports than those on page 437, Vol. II., present the following facts:—

Mr. E. C. Hungerford, the agent of this mine, reports very favorably of this new concern, which shows a large amount of mass and stamp copper for the work done. The principal shaft is down only thirty-six feet, and only sixteen feet of that is solid rock, and still a number of small masses have been taken out, and the entire veinstone is rich in stamp work. The vein has been explored and opened into in numerous places for half a mile, and appears every where regular and well defined, and at all points well filled with copper.

The Company have worked but a small force during the winter, and the work cannot be said to have commenced till about mid-winter. They have now about a dozen men, which force will be doubled in a few weeks, and the mine and surface work be carried forward as fast as possible.

HIWASSEE MINING COMPANY.

The second annual report of this Company, whose mines are located in Tennessee, presents some very successful results for the last year. On page 118, etc., Vol. I., will be found many interesting facts relative to the location of this Company.

RECEIPTS FOR ORE.

The receipts for $404\frac{1804}{2352}$ tons of ore, sold and delivered, amount to $40,492.42.

Only $6,382.41 have been expended for labor, the greater part of which has been for surface work, and in improvements at the mine. We have invested $8,983.28 in horses, mules, oxen, wagons, etc., and $5,078.67 have been expended on the Ocoee road, over which our ore has been transported since March last. A saving of $5.50 per ton of 2,000 lbs. transported, will be made to the Company by this route. To make the Ocoee a first-class road a large outlay is yet required, and several hands are still at work upon it by order of our agent.

From the statement of receipts and expenditure, it appears that the Company has, in cash and bills receivable, the sum of	$15,417 57
100 tons of ore sold to the Humphreysville Copper Company; 90 tons delivered, but not yet sampled, . . .	8,800 00
42 tons of ore sold the Bergen Port Copper Company, now in port, ...	4,500 00
200 tons of ore sold the Humphreysville Copper Company, now in Savannah, awaiting shipment,* to net free of carriage .	17,200 00
175 tons of ore at Savannah, and on the road from Mine, not yet sold, worth, free of carriage, ...	15,000 00
	$60,917 57

* May 29.—The 200 tons sold the Humphreysville Company have been shipped from Savannah, and another parcel of 200 tons, now in Savannah, has this day been sold to the Baltimore Copper Smelting Company.

To which if we add for 150 tons of ore in store at the Mine, to net, free of carriage, .	10,500 00
We have a total of	$71,417 57

The president was at the mine on the 6th and 7th April, and again from the 25th to the 28th same month. He took with him an accurate balance and all the chemicals required in the assaying of ores; hereafter, the agent at the mines will be able to report, within a fraction, the per centage of the ore shipped each month, as well as of that taken from the mine.

The president fully confirms the reports of the general agent and of the mining captain, and cordially congratulates the stockholders, not only on account of the brilliant prospects of their mining operations, which far exceed those of any other mine which has come within his knowledge, but also on the results of the year now closing, which must be considered most successful, notwithstanding the great difficulties we have met in bringing our ore to market—which difficulties, however, we believe, are now, or soon will be, effectually removed.

The first ore realized since your last meeting, was in July, and no considerable quantities were sent from the mine, as will be seen on reference to the statements, until March and April.

The Board feel satisfied that no mine yet discovered can surpass the Hiwassee in its abundance of good ore, or in the economy of its working; and they do not doubt that quarterly dividends may soon be made from the profits on ore sold, but they would not advise so doing until after the accumulation of a handsome surplus.

RECEIPTS AND EXPENDITURES FROM APRIL, 1853, TO MAY, 1854.

RECEIPTS.

Balance in the Treasury, per statement, 1853, . . .	$12,888 76
Sales of ore, 404 1804-2352 tons, as per accompanying account,	40.492 42
Received on account of ore sold, ...	4,000 00
Drafts of the general agent, and due sundry individuals—amount charged off in Expenditures, . . .	15,593 45
	$72,974 68

EXPENDITURES.

Buildings—captain's house, boarding house, mill, cabins, ore sheds, stables, etc., ...	$1,895 60
Mules, oxen, horses, wagons, saddles, etc., . . .	8,983 28
Machinery, grist-mill stones, castings for saw-mill, crusher, etc., ...	610 87
Ocoee road, expended during the year, . . .	5,078 67
First Annual Report, including Prof. Leslie's charge and expenses of himself and committee, . . .	983 94
Subscription for a church at Ducktown, . . .	100 00
Travelling expenses, and obtaining amendment to charter, .	615 54
Taxes, stationery, postages, advertising, assaying, cordage, charcoal, etc., ...	630 78
Iron and steel, and track in Mine, ...	1,478 65
Candles used and on hand, ...	455 56
Powder and fuse, used and on hand, ...	243 26
Lumber, ...	1,002 37
Insurance on ore from Savannah, ...	467 25
Carriage of materials and supplies, ...	810 40
Transportation of ore—	
675 2028-2240 tons gross by wagon to Dalton, . .	12,109 04
357 2214-2240 tons gross by wagon to Ocoee, . .	3,267 64
Railroad freight and expenses on 2,639 boxes and 194 bags, ...	7.846 85
Freight from Savannah on 2,439 boxes and 194 bags, .	1,858 60
Agency and commission, receiving and forwarding at Savannah, ...	358 64
Labor, including mining captain's salary, . . .	6,382 41
Salaries for the year ending 1st May, ...	1,626 75

Stable account,		$943 14
Teamsters' suspense account,		73 45
Interest,		229 87
		$57,557 06
Balance on hand, cash, and bills receivable,		15,417 57
		$72,974 63

ASSETS.

Real estate and mining property, at cost,	$220,000 00
Buildings, at cost,	2,874 34
Machinery, at cost,	655 37
Ocoee road—expended by this Company,	7,367 07
Horses, mules, oxen, wagons, etc.,	10,538 75
Cash and bills receivable,	15,417 57
2,427 boxes of ore, sold, now in Savannah and en route from mine, will give, free of further carriage,	41,500 00
To which may be added one hundred and fifty tons of ore in store at mine, which will give, free of carriage,	10,500 00
Total assets,	$308,853 10

LIABILITIES.

Capital stock: 60,000 shares, at $4 paid in,	$240,000 00
Drafts of the general agent, not matured, and due sundry individuals,	15,593 45
Total liabilities,	$255,593 45
Showing a surplus of	$53,259 65

REPORT OF THE MINING CAPTAIN.

Gentlemen:—In compliance with your resolution of 4th March, I beg leave to present the following statement.

I took charge of the mining operations of the Hiwassee Mine on the 6th of June, 1853. Previous to this time, an adit had been driven 935 feet in length, which communicated with the main shaft, which is twenty-eight feet deep. An underlay shaft had also been sunk twenty-eight feet in depth. A whim shaft (Tracy's) had been commenced, and sunk forty-one feet; and another (Green's) had been sunk at the north-east extremity of the property, ninety feet in depth. One hundred and ninety-nine feet had been driven in a north-east direction from the main shaft, on the course of the lode, and seventy-two feet had also been driven in a south-west direction from the main shaft, on the course of the lode.

Since the 6th of June last, I have sunk a whim shaft thirty-four feet, to complete the sinking of Tracy's shaft; and another whim shaft (Delano's), ninety-seven feet in depth, with which shafts I have communicated. I have commenced a new engine shaft, which is now twenty-four feet deep, and will strike the lode fifty fathoms below our present level. This is intended to prove the yellow sulphuret. I have driven, from the old drivage, three hundred and eighty-five feet on the course of the lode, in a north-east direction, and the vein has proved productive all the way.

I have driven four cross-cuts, to prove the width of the lode:

One at Tracy's shaft, thirty-two feet.

Sixty feet east of Tracy's shaft, one of thirty feet.

Fifty feet further east, another of thirty feet.

At Delano's, another has been driven thirty-eight feet: the whole presenting a clean bed of ore.

I have also driven one hundred and sixty-six feet, in a south-west direction, on the course of the lode, sixty feet from the commencement, through a good bed of ore, at which point the ore makes below our present level. I

have taken out about 1,100 tons of ore, and exposed to view from 3,500 to 4,000 tons more.

I have erected two whims for the purpose of raising ore at Tracy's and Delano's shafts, and three hundred and fifty feet of trestling, to convey the ore from said shafts to the dressing-house, with railroad track and cars complete.

In regard to the future prospects of the mine, I believe we will be able to take out seven to eight thousand tons of ore between Tracy's and Green's shaft, a distance of five hundred and thirty-two feet, without taking any account of the yellow sulphuret, which I believe will prove very productive.

I can guarantee to take out three hundred tons per month, for the ensuing year, and continue all the necessary drivages, shafts, and explorations, provided I can procure thirteen more good miners, not having had but three at any period.

JOHN HARRIS, *Mining Captain.*

ORE SOLD AND DELIVERED, FROM JULY, 1853, TO MAY, 1854.

To whom sold.	Boxes.	Bags.	Tons.	Rate per Ton.	Per Ct.	Value.
Baltimore Copper Smelting Co.	200		38.	$108.87	19.	$4,227.55
Bergen Port Copper Works	24	100	7.	64.48	15.	491.39
Revere Copper Company .	336		65.	63.38	15.	4,121.93
Bergen Port Copper Works		94	3.	55.59	13.	185.49
Humphreysville Copper Co.	159		26.	82.71	18.	5,810.22
	140		30.	118.55	25.	
Bergen Port Copper Works	169		32.	90.94	21.	10,159.21
	187		40.	111.73	24.	
	55		10.	84.79	20.	
	165		28.	64.96	16.	
Revere Copper Company.	174		37.	143.51	25.	15,496.63
	400		83.	121.00	22.	
	2,009	194	404.			$40,492.42

MINING IN POLK COUNTY, TENNESSEE.

The *Knoxville Register* gathers the following particulars of the mining operations in Polk county, Tenn., from a letter to a gentleman in that city. The *Register* says, "The writer is a practical man, fully competent to express an opinion in regard to the mines, and implicit reliance may be placed in his statements."

Twelve different mines are now in active operation, having each corporate privileges, of which eight are daily producing ore, and five of this number are sending ore to New York by every possible conveyance, by the Ocoee road to the Hiwassee river, two and a half miles north of Benton, thence down the river to Charleston, and over the East Tennessee and Georgia state roads to Atlanta, thence via Macon to Savannah, and thence by sea to New York. We pay at present $8.00 per net ton to the river, $1.00 on the river, $1.25 East Tennessee and Georgia Railroad to Dalton, $7.00 to Savannah, and by sea about $4.00.

The value of this ore varies from 20 to 42 per cent. of copper, and the last sales brought $5.25 for each per cent., and taking a mean as the average value of the ore, we have 31 per cent., or equal to $170.50 per gross ton of 2240 lbs.

During the month just ended, the Cherokee Mine shipped fifty tons of ore;

Tennessee, seventy tons; Isabella, eighty tons; Hiwassee, four hundred and forty tons; in all, six hundred and forty tons of ore.

The Polk County Mining Company have just begun work, and the first of their ore will leave the mines to-day. The Callaway mines have a large amount of ore mined, but have not yet made shipments. The product of these mines will increase fifty per cent. in the next six months, and were the facilities of transport equal to the capacity of the mines, I have no doubt an increase of three or four hundred per cent. would follow the present year. The tract of country covered by the mines is about three miles in longitude, and six in latitude. The strike of the mineral vein is about north 32° east. About thirty Cornish miners are at present employed, with about four times that force of ordinary laborers. There are some fifty now in transit from Cornwall, and are daily expected in Charleston. Sometimes the miner works on dead ground, and it would be difficult to estimate otherwise than from the above data. Say one hundred and fifty men produce six hundred and forty tons per month. This would be $\frac{64}{300}$ of $170.50 as the daily product of each hand.

GEORGIA COPPER MINES.

A letter from Dahlonega, Georgia, presents the following picture of the state of the mining excitement in that region:—

It is surprising to witness the extent of the copper mania, (I can give it no other name;) farmers, mechanics, lawyers, physicians, and merchants, indeed, all classes, are taken down with the copper fever; the disease has become chronic. Now what is the cause of this? It is true, copper in small quantities is discovered on an outcropping lead that extends through the county from south-west to north-east, and the precious ore is found more or less through the whole extent. Shafts and tunnels are being sunk eight miles north-east of this place, and the indications are highly favorable for a rich development. Companies enter upon these lots, and agree to test them effectually for half; others, again, buy conditionally—one lot thus taken lately, was taken by paying one thousand dollars cash, and thirty-nine thousand dollars more if the copper is found in quantity. The indications are good over a large extent of the county. Tests of a simple character are being made, and where copper is found, high estimates are placed upon the property. Alladin's wonderful lamp would be but a sequel to those estimates. Indeed the Magnus Apollo of copper hunters and rockology amongst us, scarcely ever gives us an estimate of less than one or two millions for a forty-acre lot. These enormous calculations have so inflated the price of lots, where copper indications are found, that they scarcely can be purchased at any price; and I opine that, if there are rich copper mines here, they will not be developed until this wire edge wears off, and more sober calculators make the estimate. These veins or beds of copper ore are yet small; they produce the black oxide, yellow sulphuret, and in one instance, the gray copper ore. All are yet in too small quantities to be profitable; yet opinion concurs in the belief that they will shortly lead to extensive beds, and be immensely profitable. The veins are encased usually in micaceous or talcose schist, in chlorite and hornblende, rarely in gneiss or granite. The outcrop indications in the aggregate are a conglomerate of earthy matter, quartz, slate, with sulphuret and black oxide of iron. Gossin, as it is here termed, or common tufa, are the indications on the copper beds and outcrops. The county is of primary formation, the upheavings very irregular, and the inclinations north-east almost invariably. Water is generally found from thirty to eighty feet below the surface. I have been inclined to the opinion that the probabilities are against a rich copper region; others, whose experience dictate to them other opinions, think that Lumpkin county is the most extensive and richest copper region in the world. Cornwall is a perfect farce. Men

of science can, and perhaps have, determined the question, whether extensive copper beds have ever been found to exist in primary formations.

Turning from this copper theme, not yet having been taken with the monomania, or turned green by the application of verdigris, I can soberly say that, as for gold, I think that nothing is wanted but energy and capital, to insure princely fortunes in this county.

NEUVITAS COPPER COMPANY.

The following statement of the President of this Company, Mr. F. G. May, contains some facts respecting the mine and operations of the Company, not before stated in our pages:—

The mine is twenty-six miles distant from Neuvitas, twenty-two of which can be traversed by railroad. The remaining four miles of the distance is by a good road over an undulating country. Throughout the whole district of Bayatabo, until I reached there, I observed unequivocal evidences of copper-bearing rock.

When I arrived at the mine, I was pleased to find that the work was progressing with activity, under the superintendence of Mr. McCafferty. Nineteen days previous to my arrival, the pumps had commenced working in the shaft.

At this period of our operations (April 26), the number of laborers employed is twenty-eight. It will be expedient to increase the number, in a few months, to sixty or seventy; as they can be employed with great profit to the Company in the shafts, levels and drifts, and in preparing ore for market.

The price of labor is twenty per cent. lower than in the United States, and with the genial climate of the island in our favor, our operations can progress uninterruptedly. The prices of provisions do not rank as high as in the United States or Europe, the principal articles being those raised in that country—for instance, jerked beef, rice, plantains, yams, etc., and coffee and sugar.

In the titles granted to us by the Government, we are allowed the use of all the timber required for our operations. No woods in the world can excel those of Cuba in strength and durability; and, as there are three contiguous setts of six hundred feet in length and three hundred feet in breadth, each, there is an abundant supply at our command for half a century at least, within a hundred yards of the seat of operations.

The buildings belonging to the Company, now erected, will be sufficient for all purposes for years to come. They consist of a lodging-house for the laborers, sixty feet by thirty, an office fifty feet by twenty-five, containing three apartments—for the financial agent, the mining superintendent, and the engineer, with a room for storing provisions. There is a good engine-house, blacksmith-shop, carpenter-shop, and powder-magazine. A cook-house, and a house for dressing the ores, were under process of erection before I left the mine, and have been finished ere this without a doubt.

The rollers and crushers shipped by the Company in November last are erected, and, when needed, will be brought into action. At present, but a small portion of the ore produced requires crushing, and can be shipped at a large profit. Previous to my having left the mine, I requested the Superintendent to give me a full report of its condition and prospects. His reply is here appended:—

Report of Superintendent.—The shaft is fifty-four feet deep; the bottom of the level is thirty-nine feet six inches from the top of the shaft, or about thirty-seven feet from the natural surface where the shaft was commenced.

We can get from half a ton to one ton daily of ore, with two men in the level, and the greater part of the time but one man. My principal object, however, is, to continue to sink the shaft as fast as possible to the greatest

depth the pump will allow us to go, as it is very important to get down now, while we have the dry season in our favor.

We can sink with the pumps we have eighty-five feet deep. My intention is to leave about five feet of the bottom of the shaft as a reservoir for water, and commence driving the next level at a depth of eighty feet, where we will have to drive about thirty feet to cut the lode; and that you may judge *hereafter* whether I have any knowledge of this ground or not, I will now state to you what the vein is like ten feet below our present depth. The vein of quartz is about twelve feet thick, carrying a lode of yellow ore, coated with black. This part of the vein is very uniform, and free from spar, and there is a considerable quantity of yellow ore scattered and mixed through the other parts of the vein. At the depth I propose to drive the next level, I apprehend no difficulty in taking out from five to six tons per day of good ore.

H. McCAFFERTY, *Mining Superintendent.*

My descent into the shaft, previous to the above report, discovered to me the gratifying fact of an immense vein of copper. I have not the least doubt, from my observations, of the presence of the large lode described by Mr. McCafferty. I think, with him, that he can take out, when at the depth of eighty feet, the number of tons of ore mentioned, (five or six per day.)

There were about thirty tons of ore on the surface, when I left. It is Mr. McCafferty's candid opinion, that on or about the first of May, the Agent will be able to ship one hundred tons of yellow sulphuret of copper, averaging twenty-five per cent. It can be hauled to the railroad, leading to Neuvitas, at a small cost per ton, by ox teams. The freight on the railroad, although higher than in the United States, together with the export duty of $3 per ton, and the freight on vessel to New York, will not amount to more than $12 per ton. Efforts were making before I started, on the part of managers and owners of mines in the district, to have the price of freight reduced on the railroad, on copper ores; and I was assured that their efforts would result in the desired reduction.

NAPIER'S PROCESS FOR SMELTING COPPER.

This is an improvement upon the old method of smelting copper, and although patented a few years since, we regard it of sufficient interest to be inserted in these pages. The number of processes that ores have to undergo, by this method of smelting, before copper fit for the market is obtained, is five.

I. *Calcination of Ores.*—There is no change in this process.

II. *Fusion of Calcined Ores.*—The former part of this process is also performed in the same way as in the old process, but in the latter part there is a change. After the slag is skimmed off, a quantity of sulphate of soda and coal is added to the mineral which remains. After this mixture is stirred well and fused for about ten minutes, it is tapped out into sand moulds; when this is set or solidified (but not cold), it is thrown into large tanks filled with water, where it slakes and falls into a fine powder something like slaked lime. The sulphate of soda, which was added to the metal when in the furnace, is reduced by the coal which was added at the same time, into the sulphuret of sodium, which combines with the sulphuret of iron and copper, and dissolves out what impurities the ores might contain, being carried away by the sodium into the water. The water in the tanks is now drawn off by taking out a plug, and the metal is got at the bottom of the tank. The following is its composition:—Copper, 34·56; sulphur, 24·05; iron, 39·90; silica, 1·50.

III. *Calcination of Washed Powder.*—This operation is carried on in the same way, and takes the same amount of time as the calcination of the gran-

ulated coarse metal. But the metal, in this case being in a powder, loses the most of its sulphur, and requires but one fusion to bring it to copper:—CuO 86·700, FeO 52·210, SiO_4 10·200, S 1·641.

IV. *Fusion of Calcined Powder.*—The calcined powder is mixed with a quantity of carbonaceous matter (coal), and introduced into the furnace through the hopper. When this is fused, the doors are taken down and the liquid mass stirred; it is then allowed to remain for a short time, when the slag is skimmed off, the top hole is then opened, and the metal allowed to run into sand beds. The product is coarse copper.

V. *Refining or Toughening.*—No change in this process.

AMERICAN MINING COMPANY'S MONTHLY REPORT FROM THE MINES.

Prepared for the Mining Magazine, by E. P. Wood, M. D.

Jamestown Mine, Wisconsin.—[Extracts of letters from W. B. Colburn, Agent, May 29th, 1854.]—The miners who are sinking the Richards shaft have just got a hole through the cap rock, through which Mr. Gray, our Mining Engineer, has crowded himself, and finds an opening, in which he has crept 100 feet east, and some 75 feet west, finding mineral most of the distance in the cap rock, and also many pieces in the top of the clay. One piece he thinks will weigh 200 pounds. He is highly pleased with the prospect.

May 31st, 1854.—On the pump shaft range, yesterday afternoon, they struck a new small opening bearing mineral, and took out 600 pounds in a very short time. The opening seems to run east and west, and is looking fine indeed. It is entirely below anything ever done upon the range before, and we have reason to hope it will prove of importance.

June 1st, 1854.—They have sunk the west shaft on the Thomas range about 10 feet, and have taken out nearly 3,000 pounds of mineral. Last night they drew out two pieces, which together I think will weigh 700 pounds. The crevice is 18 inches wide, and good mineral going down each way. It is a favorable appearance, as it is clear below any old works on the range.

June 6th, 1854.—Yesterday, those who were mining on the Thomas range, took out 2,000 pounds of fine mineral, and have it good going ahead, east. In the Richards shaft they have sunk in the clay about 5 feet and finding small pieces of mineral. The crevice is now about three feet wide.

June 14th, 1854.—The miners began to take out mineral again, from the Wilson shaft, Thomas range, Monday night. This morning there is on the ground, ready for the smelter, at least 400 pounds. I had Mr. Wilson, formerly the boss miner here, thoroughly examine the ground yesterday, and he reported very favorably indeed. The mineral is still good going east. They have not yet drifted any of account west.

Cabarrus Mine, N. C.—May 30th, 1854.—[From A. A. Parker, Esq., General Agent.] Set two hands under ground to-day. They cleared out the bottom of the shaft and began to take out ore, at near night. Some 8 or 10 bushels were got out which pans very well. Have all the carpenters getting out timber for the screen frame and for the capstan and shears. Both of our buildings are ready for the machinery, which is nearly all here. The boiler foundation was finished to-day. Fly-wheel pit nearly done.

[From J. Williams, Mining Captain, and Kinney and Fillman, Engineers. —June 6th, 1854.]—We find the engine shaft well timbered for 76 feet, and the shaft squared down 14 feet deeper, 6 by 8 feet. In the bottom of shaft is a vein of quartz, spar and killas, carrying, however, brown gozzan and ore, with sulphuret of iron and copper. At a point 84 feet from the top a drift is extended some 90 feet. The course of that drift is east and west, and dipping some 12 inches in a fathom north. The narrowest place we observed in the vein was five inches, and the widest point three feet.

It would safely average 10 inches, driving the whole distance. Extending west from the same level, is another drift on the course of the lode about 15 feet. The vein at the further end of this drift is about nine inches, and the

narrowest place about five inches; and is composed of the same material as in the other drift. It appeared to be a very strong vein and perfectly regular. We broke from this drift say half a pint of the material, and selected one of the miners to pan it. There was obtained about two grains of gold. It is proposed to go down with this shaft, as the vein seems to become larger and more regular below, with beautiful smooth walls of granite and shale, the vein itself being enclosed in killas, with prian and gozzan. Green and yellow copper being disseminated through the lode, as a copper lode alone it seems to be valuable, independent of the gold. We have seen gold panned at several mines since we came to this State, but that which we broke from this vein to-day was the richest we have seen. We have seen and traced this vein some 240 feet east of the engine shaft, and 400 feet west. The vein is hit and opened to some considerable extent. Above it outcrops to the surface. On the whole we consider it a vein well worthy the attention of the Company.

Messrs. Cobb, Hill, and Company, are now erecting a steam-engine for the Company over this shaft, and the pumps for it are laying at the mouth of the pit. The timber for capstan and shears is all out, and the engineers are now putting up the machinery for the mines.

[From H. B. Fairbanks, Agent, same date.]—I can only say in addition to the foregoing: the Company are now fast opening two other veins, that belong to the Cabarrus Mine, which will even surpass this vein in richness and extent.

[From William Everhart, Mining Captain, June 10th, 1854.]—On Monday last I went to the Damascus vein, to prove it and take out ore. I commenced at the branch in the low land and went up the hill, sinking on the course of the vein, and hitting it at different points, for a distance of 200 feet, from 6 to 10 feet from the surface. The vein proves to be good as far as we have followed it, for the labor already done yielding 146 bushels. The ore above water has been nearly all taken out, and is estimated to have been worth one dwt. per bushel. The vein is composed of quartz, sulphur, and copper.

San Augustine, Cuba.—[From H. P. Chamberlin, Esq., Agent, May 9th, 1854.]—We are looking much better this week than for some days past. In the back of the eastern level of the winze, we have come upon some very fine ore in stoping, equal to that we have been raising. The cross-cut from the 12-fathom level is being pushed. Our whole force east has been employed on the winze levels. This is a very strong, highly promising lode, and although varying much in its underlay, yet keeps its width of a fathom well defined.

May 15th, 1854.—To-day we commenced stoping the back of the cross-cut, as we are in 30 feet. In the winze we have opened a communication with the level above. The bottom of the winze is only 90 feet from surface, and by sinking four fathoms more, we shall have eight fathoms of stope to fetch a level in on. The weather has been very rainy for the last week, but has proved first-rate for the farm. Fodder is an article of great importance to us. I have planted cane, and corn enough if the weather is anyways propitious, to give us a good harvest.

May 21st, 1854.—We are raising some splendid ore from the west of the shaft, and not far from the mouth of the level. The winze has looked much better for the past week, and we are driving our east end in good spar.

June 7th, 1854.—We have driven on the main lode, as it appears in the winze, 40 feet east, and 30 feet west, and stoped on it the height of three fathoms. In both ends the lode has a northerly underlay, and is still making down. In the lowest part of the workings, and two fathoms further north, we have driven in east and west, and still find the lode showing its continuance, although much broken by killas. On the west of the shaft, we have, in the 12-fathom level, raised some fine yellow ore, by stoping the back. A cross-cut has been driven 12 yards south, through lody ground, and the end shows stones of good ore. The cobbing-house is full of good dredge work,

fit for a crusher, and the jigging-house is fast filling up also. As soon as the roads become passable, I shall ship you a cargo of our prills, and from the richness of which our cob work may be judged.

San Antonio Mine.—[James Porter, Agent, Monthly Report, May 31st, 1854.]—The whole number of days' work done on this mine during the past month is 68½. Whole distance drove on 18-fathom level, 105 feet east, from north and south drift, and we are now driving upon the direction of the lode. This makes in all 800 feet of drifting on course of lode; without including 130 feet of old adit. On 30-fathom level, 17 days' work done and 18 feet gained, 18 feet further to drive to reach where A. Bareto left ore, as he says. Upon south lode 10 days' work done, and 200 feet of air-pipe made and put into Lloyd shaft.

JOURNAL OF SILVER AND LEAD MINING OPERATIONS.

AMALGAMATION OF SILVER WITH MERCURY—GERMAN METHOD—MEXICAN METHOD.

The amalgamation of silver with mercury is a property which is taken advantage of in Europe, Mexico, and South America; and the process is, perhaps, more systematically and economically conducted at Halsbrücke, in the vicinity of Freyburg, than in any other locality. The usual constituents of the ores there are sulphur, antimony, arsenic, silver, copper, lead, iron, and zinc, which are more or less mixed with various earthy minerals, besides sometimes containing small quantities of bismuth, gold, nickel, and cobalt. In the selection of these ores they are so assorted as not to contain above seven per cent. of lead, or one per cent. of copper, as, by combining with the mercury, these metals give to the amalgam a pasty consistency, rendering the treatment difficult and expensive.

The mixture of the different ores is so arranged, that the charges to the furnaces shall contain from seventy-five to eighty ounces of silver to the ton of mineral: and it is also essential that they should contain a certain portion of sulphur. This usually consists in the form of iron pyrites; but if, as is sometimes the case, the amount of pyrites in the ore is insufficient, addition is made of this mineral, or of ready formed sulphate of iron. The ore thus prepared is laid on a large floor, forty feet in length, and about twelve feet wide, and over it is thrown ten per cent. of common salt, which is let drop from an upper room through a spout. The heap, made up of alternate layers of ore and salt, is carefully turned over, mixed, and made up into parcels of from 3½ to 4½ cwts., each called "roast posts." These are roasted in reverberatory furnaces, provided with fume flues for the reception of any pulverulent matters which may be mechanically taken over by the draught. The charge is spread on the bottom of the hearth, and at first very gently heated to expel the moisture. During the process of drying (about two hours) the stuff is constantly stirred, and when this operation is sufficiently advanced the heat is increased so far as to cause the ignition of the sulphur, and to render the ore red-hot. The furnace is kept at this temperature four hours, when the metals become oxidized, and sulphurous acid gas is rapidly given off; constant stirring prevents the ore agglutinating in masses. The temperature is now further raised, and more sulphur is evaporated, with vapors of chloride of iron, and hydrochloric acid. This last firing lasts three-quarters of an hour, with constant stirring, until a sample gives no odor of sulphurous acid. The charge is then raked on the floor to cool, ground in mills, and passed through sieves, until a powder is produced impalpable as the finest flour. At the Halsbrücke Works there are fourteen roasting furnaces, and as many pairs of granite millstones, which together are capable of preparing and grinding 70 tons of ore per week.

The reactions produced by the process of roasting are the following:—The sulphurets of iron and copper give off sulphurous acid gas, and are trans-

formed into oxides and sulphates. The sulphuret of silver, on being heated in contact with the sulphates of iron and copper, is also converted into sulphate, while the metals become oxidized, and sulphurous acid is evolved. The sulphates of iron and copper, together with the salt, become fused even below a red-heat, and if sulphuret of silver be present in the mixture, a further amount of sulphurous acid is evolved, through the decomposition of that mineral produced by the reaction of its sulphur on the sulphuric acid of the sulphates: while sulphate of soda, chloride of silver, and the chlorides of copper and iron, are formed at the same time. When these reactions are conducted with free access of air, the iron becomes partially converted into a sesquioxide, and a corresponding quantity of the sesquichloride of that metal is produced. The sulphurets of antimony and arsenic are likewise at the same time oxidized, and we may therefore regard the roasted ore as being composed of sulphate of soda, chloride of sodium, chlorides of manganese and lead, sesquichloride of iron, subchloride of copper, chloride of silver, sundry earthy impurities, and various metallic oxides.

The amalgamation of this prepared ore is performed in 20 wooden casks, arranged in four rows, each turning on cast-iron axles, secured to the ends by bolts. They are 2 feet 10 inches long, 2 feet 8 inches in internal diameter, made of oak staves, 3½ inches thick, and further strengthened by iron hoops: on one of the ends of each is a toothed wheel, which by gearing with other wheels, in connection with a water-wheel, is kept in constant rotation; the prepared mineral is fed into the barrels by a hopper, having a leather hose as a terminus, and at the commencement of the operation 3 cwts. of water are run into each other, after which 10 cwts. of the finely-powdered ore are introduced through the hose. To these are added from 78 to 100 pounds of wrought-iron, cut into fragments of 1 inch square, and ⅛ inch thick, which, as they become dissolved, are replaced by fresh pieces. The casks are now tightly closed by screw stoppers, thrown into gear, and made to rotate 18 to 20 revolutions per minute. In two hours they are examined, and as the paste is too thick, or too watery, water or powder is added. This attended to, 5 cwts. of mercury are added to each cask, when they are again closed, and set in motion, and kept constanly rotating from 16 to 20 hours, at the rate of 20 to 25 turns per minute, during which period two examinations are made as to the state of the paste. At the expiration of the operation the tuns are entirely filled with water, and again set in motion for two hours, at the rate of eight revolutions per minute. The amalgam is thus separated from all slimy matters: when at rest it is found in one mass at the bottom of the barrels, and is run off into a proper receptacle. The residuary ore is found to have given up all its silver to within 5½ ounces per ton, and is frequently subjected to a further amalgamation. In 14 days 160 tons of mineral are treated in this establishment, every 5 tons of which require an expenditure of 15 pounds of metallic iron, and 2 pounds 12¾ ounces of mercury, so that every pound of metallic silver produced is obtained at an expense of 0.95 ounces of mercury.

The mercury and amalgam obtained from the casks is afterwards filtered through close canvass bags, by which the liquid mercury is separated from the pasty amalgam, which is retained by the closeness of the web, while the mercury passes through into reservoirs prepared for the purpose. The pasty amalgam consists of six parts of mercury, and one part of an alloy, composed of about 80 per cent. of silver, and 20 per cent. of a mixture of copper, lead, bismuth, antimony, gold, nickel, zinc, and some other metals. This mixture is heated in a distillatory furnace, and is thus freed from the adhering mercury, while the non-volatile constituents of the alloy are obtained in the solid form.

The Mexican method of amalgamation, although the same in principle, is conducted under different mechanical arrangements. The mineral having been reduced to a fine powder is spread on the ground in large circular patches, from 30 to 50 feet in diameter, and 1 foot thick, called "tortas." At Zaca-

tecas, each torta contains 60 tons. In the centre of the heap is thrown 150 English bushels of salt, mixed with earthy impurities, and is intimately mixed, first by wooden shovels, and afterwards by the treading of horses or mules. When thus mixed, they are allowed to remain until the next morning, when after an hour's treading, from ½ to 1 per cent. of copper pyrites, called "magistral," is added, containing about 10 per cent. of sulphate of copper, which appears to be the active principle that effects the subsequent chemical changes. The torta is again well trodden by horses or mules; and, when perfectly incorporated, a quantity of mercury is added through a canvass bag, which delivers it in innumerable small jets over every portion of the surface. It is then alternately trodden, and turned by wooden shovels, until the silver has taken up all the mercury. A second portion is added, and the same process repeated until no more mercury can be absorbed. The duration of the operation varies considerably in accordance with the nature and richness of the ores and the temperature of the atmosphere; in winter the reactions proceeding less rapidly. The amalgam is then washed, the fluid mercury separated by leather or canvass bags, and the amalgam sublimed in a furnace producing the resulting metals in a solid state.—*London Mining Journal.*

CONCENTRATION OF SILVER IN LEAD.

What is known as Pattinson's process, although frequently alluded to, has not been described in detail in our pages. We subjoin an acccunt of it:—

The inventor, Mr. H. L. Pattinson, noticed the circumstance that lead containing silver, on being melted and allowed to cool slowly, with constant agitation, deposits, at a temperature a little under the fusing point, small crystals of metallic lead, which fall to the bottom, and on being drawn out are found to contain much less silver than the original, and, by that means, the mother liquor becomes proportionably richer in silver. The discovery and application of this fact constitutes the groundwork of the Pattinson process, which is extremely simple in its nature.

A series of ten cast-iron pots are placed in a row, with a fire-place underneath each. At the extreme right of the series is the *market* pot, from which the poor lead—that is, after it has been desilverized—is laded out into moulds. It is a little elevated above the adjoining pots, which are called *working pots*, from the lead being crystallized in them. Each pot is capable of holding about five tons of molten lead. On commencing the operation, the lead is introduced into a pot in the middle of the series and melted; and, after being fused, it is carefully skimmed with a ladle perforated with small holes, and the fire withdrawn from under the pot. The lead is now allowed to cool slowly, and during this time it is constantly stirred with a long iron ladle, and in a short time crystals of lead begin to fall to the bottom, which are removed by means of a long perforated ladle, and deposited in the adjacent pot to the right in the series as fast as they accumulate. This operation is continued until about four tons of crystals are removed from the original lead. The remaining one ton is now generally richer in silver. The enriched lead is laded into the next pot to the left in the series, and the same process repeated on a fresh quantity of lead in the same pot, and the crystals removed to the pot to the right, while the enriched alloy is passed to the left. The pots in either direction, after being filled with lead of their own quality—that is, as regards silver—are liquified and crystallized; the poor lead still passing to the right, and the rich to the left, and so on until the poor lead reaches the market pot, and the rich lead the other extremity. It follows that the pots to the right must become gradually deprived of silver, and those to the left must become proportionably richer. In the one instance, the lead to the right ultimately contains a mere trace of silver, while that to the left becomes very rich and yields a considerable quantity on cupellation. Between every two pots there is a small pot, called *temper pots*, containing fused lead at a con-

siderably elevated temperature, for the purpose of introducing the ladle employed for taking out the crystals when it becomes *chilled*—that is, the lead adheres to it so firmly as to stop up the perforated holes. They are generally two feet in diameter, and therefore just admit the ladle in an upright position. The following are analyses of the skimmings and the lead obtained from them by reduction, and also of the market lead, market crystals, and rich lead from the crystallizing process:—

Skimmings.—Lead, 98·10; antimony, 0·28; copper, trace; iron, 1·4; lime, 22: total, 100·00.

Skimmings reduced.—Lead, 99·72; antimony, trace; copper, trace; iron, ·28: total, 100·00.

Market Crystals.—Lead, 99·9; iron, 1; antimony, trace; copper, trace: total, 100·00.

Market Lead.—Lead, 99·9; iron, 1; antimony, trace; copper, trace: total, 100·00.

Rich Lead from crystallizing process.—Lead, 99·8; iron, 2; antimony, trace; silver (?): total, 100·00.

ASSAY OF SILVER.

When silver is contained in an ore, the powdered mineral may be dissolved in strong or dilute pure nitric acid, and the silver thrown down with chlorohydric acid, and estimated as chloride of silver. In the dry assay, the ore is fused with lead in a crucible, the silver is taken up by the lead, which is then placed in a cupel, ignited with a current of air directed over it; the lead is oxidized, and sinks into the bone earth cupel, while the pure silver remains, and may then be weighed. To purify silver from other metals, it may be dissolved in nitric acid precipitated by common salt, and the moist chloride decomposed by strong caustic potash solution and resin, into the oxide which may be employed for making the salts, or the dry chloride may be fused with carbonate of soda and resin, and thus obtained in the metallic state; or, 8 chloride, and 1 resin, may be heated in a crucible, gradually raised to the fusing point of silver, and a small portion of borax added; silver is speedily reduced.—*Mohr.*

SILVER MINES IN TALLAPOOSA, GEORGIA.

This county is now realizing one of those excitements produced by the discovery of precious metals in large quantities, to which she has occasionally been subject to for many years, that bids fair to equal any of its predecessors in intensity, and probably with juster causes. It has been known for several years that silver existed in large quantities in the south-western portion of this county, or rather south-west of this place, in the neighborhood of Blue Creek, and between there and Tallasee Falls. But they have heretofore been unable to do what they seem now to have accomplished with complete success, discovered means by which they are enabled to separate the silver from the ore and other metals with which it is mixed. By this process we learn that a company the other day extracted, in a very short time, sixteen pounds of pure metal, which set the county in a rage.

LAKE SUPERIOR SILVER.

The first steamer from the mines this spring brought down a very large number of miners, and many of them appeared to have been fortunate in possessing themselves of specimens of silver, and silver and copper, found in our Lake Superior mines. Some of them were by far the most massive and beautiful pieces of pure native silver we have ever seen, weighing from an ounce up to several pounds of the pure metal. They were splendid cabinet specimens, and were held at prices far above their intrinsic value by weight,

some of them being offered at as high as one hundred dollars for pieces not weighing over twenty-five dollars each. Almost every one had his specimens, worth from five dollars to fifty dollars, and many of them were well worth the prices asked, for cabinet specimens.

We understand that most of this silver must have come from the Minnesota, during the past winter, where a large quantity of this precious metal has been lately found. This mine is growing rich in silver, and we learn that the company have saved considerable from the miners, who, at all the mines, contrive generally to appropriate the most of it to their own use. Most of the native copper veins on this Lake produce more or less silver, and as they are worked at greater depths, we shall not be surprised to hear of "masses of silver."—*Lake Superior Journal.*

SILVER MINES AT CARUPANO, VENEZUELA.

According to the news lately received, under date of La Guaira, 9th May, the lead, silver, and gold mines at Carupano are improving in richness to an astonishing extent.

In the Rivilla Mine, actually worked by German miners hired in New York, a vein of silver and gold was discovered in April last, yielding the immense proceeds of twelve pounds of silver and one pound of gold in one hundred pounds of ore. Such a result keeps high the spirits of the miners and of all concerned. This mine is situated about two miles from the coast, and in the same range as the Gran Pobre silver mine, reputed for the abundance and richness of its ores to be one of the best silver mines ever worked. The Rivilla mine is worked by a small Company raised in the country, with very limited means. It is thought that the mines of Venezuela may soon rival the famous mines of Copiapo, in Chili, which are yielding so rich profits to the proprietors, as will be seen in other pages of this number of the Mining Magazine.

LINDEN LEAD COMPANY.

The property of this Company is located in Iowa county, Wisconsin. It comprises about nine hundred acres, including what is known as the Heathcock Mine. The report of Professor Daniels, State Geologist of Wisconsin, contains some very interesting and valuable facts of a general nature, which we here insert:—

The deposits of lead and copper in your mines have already been proven, by an abundant yield of ore, wherever discreetly worked, to be very large. But it is of the highest practical importance to determine whether they are of such a character as to justify those extensive and permanent mining operations which alone can be profitable for a long period of time. Omitting those details which would be of no interest except to the professional geologist, I will simply state those general conclusions which I have arrived at, from a careful examination of the mines and the region in which they are located.

1st. The geological position of these mines is highly favorable.

They occur in a series of rocks, consisting of sandstones, shales, and limestone, known to the geologist as the Silurian formation.

Their immediate association is with the limestone known as the cliff or mountain limestone. It is in this rock that the great lead mines of Europe, and, in fact, the most productive mines upon the globe, are found.

2d. In their mode of occurrence, the ores in the vicinity of Mineral Point give most favorable indications. They occur in fissures inclosed by walls of the surrounding rock, from which they are usually separated by a very distinct line of demarkation. These fissures often extend many miles in a horizontal direction, and vertically to a great but unknown depth; carrying

with them abundant ores of lead, and zinc, or copper. They are therefore *true* veins, and not isolated masses of ore, sometimes called contemporaneous veins, or beds, which yield largely at first, but are soon exhausted. It is upon veins of this character only that the intelligent engineer can rely for a permanent supply of the ore which he is seeking.

One very favorable indication which I observe in your district, is the interruption of the veins in passing through a change of rock. This is the case with *true* veins everywhere. When passing from one rock to another, they generally become pinched, or entirely lost, but are sure to open again below. In the English mines it is not uncommon to lose a vein in this way, at the junction of two rocks. But they are followed down; and the miner relies with unshaken confidence upon their eventual recovery, though it may be hundreds of feet below the interruption.

These veins, then, may be regarded as deposits of a permanent character, upon which reliance may be safely placed in practical operations.

3d. The extent of the country which they traverse, both vertically and horizontally, (of which a mere fraction only has yet been worked,) must be taken into account in settling the true value of these mines. Only a small portion of the surface, compared with its whole extent, where veins might be reasonably expected to occur, has been broken. From all indications visible, the probabilities are very decisive, that numerous localities, not yet proved, will be found rich in veins of ore, at the depth where they have usually found the superficial openings. But even suppose the surface mineral entirely exhausted, we have reliable evidence of the existence of deeper stores not less abundant. To appreciate fully the nature and value of this evidence, the relations of the beds of rock must be known, and the fact must be borne in mind, that *true* veins increase in productiveness as they descend.

In these mines (Heathcock's), the most valuable and productive flat sheets yet discovered in the mineral district, are being worked in the lower openings. There can be no reasonable doubt that these lower openings contain vast stores of ore, which have just begun to be opened. Here, then, is a new region, as yet unexplored, but giving promise of rich returns, to the intelligent and persevering miner. In working out the mineral deposits, a sandstone will be encountered: this rock, so far as is known, is not lead-bearing. It is about one hundred feet in thickness at Mineral Point; below it, sets in another limestone, known as the Lower Magnesian. Here, according to all experience elsewhere, we may confidently expect the veins to open again and produce their ores. The probability of such a result is still further increased by the fact, that in several localities where this rock has been brought to the surface, either by elevation, or by the wearing away of the superior rock, it contains deposits of lead ore.

By sinking through the sandstone, these would be reached, and the extent of the mining country, in a vertical direction, fairly proved.

From these facts, I feel safe in the conclusion, that not one per cent. of the ore of your mines has yet been raised; and that, instead of being nearly exhausted, the work thus far performed has only opened the door of those vast mineral treasures which lie inclosed among the strata of the lower limestones.

Nothing is wanting but combinations of labor and capital, under the direction of intelligence and sagacity, to prosecute those extensive and persevering explorations which have elsewhere proved so profitable, to open here sources of mineral wealth that centuries will not exhaust.

Thus much I have thought myself warranted in affirming as to the prospect of continued productiveness in the veins of ore. I will add a few words upon the qualitative value of some of the ores. The value of the lead and copper ores is too well known to need mention. But your region furnishes a class of ores of great value, which has received, as yet, little attention. I allude to the ores of zinc found there in exhaustless abundance. The prin-

cipal ores of this metal are, the carbonate (called Dry Bone), and the sulphuret of zinc (known as Black Jack).

The former, called "calamine" by the mineralogist, is the best ore of zinc in the world, on account of its richness, and the ease with which it is reduced. The sulphuret of zinc is a valuable ore, but more difficult to reduce to metallic zinc; it is, however, the ore generally used in the manufacture of white vitriol.

From the carbonate of zinc, and sulphuret of copper, brass may be manufactured directly from the ore; or, the metallic copper may be combined with it, to obtain brass. Thus, then, in three methods at least, these ores may be rendered profitable.

1st. In the manufacture of metallic zinc.

2d. In the manufacture of brass, by combining it with the copper ores, which nature has placed near it, seemingly for this very purpose.

3d. In the manufacture of white vitriol, now a business of great value and importance.

For all this but two elements are wanting, viz.: fuel, which your contemplated railroad will soon bring from the coal-fields of the South; and capital, which must soon flow to a point of investment certain to yield rich returns.

From my examination of the Mineral Point mining district, I am satisfied that in the abundance and variety of its ores, in the peculiarly fortunate association of copper and zinc, and in its position as to access, and the transportation of its products, it is not surpassed by any other upon the globe. Comparatively unknown as it now is, it will yet vie in richness with the famed districts of Europe, when it shall be explored, with abundant capital, guided by practical skill and enlarged views of its true character and value.

MINERS' WAGES IN WISCONSIN.

Miners' wages average somewhere from $1.50 to $2.00 per day; that is, the product of a day's labor at mining nets somewhere about that to all who work, and try to make anything. There are very few that hire out by the day, and those that do, commonly get less, because they are worth less, from a lack of energy and their inability to earn full wages.

Our best miners calculate on making three dollars, or upwards, a day; but they are men who count on working briskly, over six hours a day, and getting rich at it. By custom, six hours' labor at mining make a day's work, and the custom also prevails, among many, of spending the other six hours of the day in saloons; by which latter custom, the earnings of the first six hours are spent, or nearly so. The present crop of miners exhibit vast reforms over their predecessors, however, and in a few years will extinguish most of their old customs.—*Galena Jeffersonian.*

MISSISSIPPI MINING AND MANUFACTURING COMPANY.

A Company bearing the above name, the stock of which is principally owned in New York, have leased a valuable tract of mineral land, about half a mile from Shullsburg, on the Galena road, with the intention of pursuing, as the main object, a thorough and systematic search for lead ore. An engine-house, blacksmith-shop, boarding-house, and several smaller tenements for laborers, have been erected; an excellent and powerful engine has been set up, a pump-shaft about eighty feet in depth has been sunk, and operations below ground have fairly commenced. It is found, so far as the experiment has been tried, that the machinery, running at its lowest possible rate of speed, will keep the ground dry, as far down as the pump-shaft extends. The water is already reduced several feet below its ordinary level, and several ranges, heretofore below low water mark, are now being worked by "prospectors" on the leased ground, with the most flattering success. It is the

intention of Mr. Bellows, the agent of the Company, to put into operation a planing-mill, circular saw, etc., to be driven by the engine now employed alone in pumping; but these will be, as long as mineral can be found, secondary objects.

The ground covered by the Company's lease is said to be as valuable, for mining purposes, as any in the mining district. Worked above water, it has already made the fortunes of several persons, and it is known that vast treasures of ore are yet uncovered, having been heretofore inaccessible. It is the opinion of those well qualified to judge of such matters, that, with ordinary prudence and diligence, no such thing as a failure can occur in the prosecution of the enterprise in which the Company is engaged.

COALS AND COLLIERIES.

ANTHRACITE COAL TRADE FOR 1853.

Shipments from Richmond to the close of the week ending June 10th,	490,453	tons.
Same time last year,	380,226	"
Increase,	110,227	"
Amount sent by Reading Railroad to June 15th,	859,979 16	"
" Schuylkill Canal,	307,058 15	"
Total,	1,167,038 11	"
Same time last year,	926,172 14	"
Increase,	240,865 17	"
Lehigh Coal Shipments to June 10th,	260,394 19	"
Same time last year,	285,992 07	"
Decrease,	25,597	"

CUMBERLAND COAL TRADE.

Mount Savage Railroad to Jan. 10th,	60,120	"
Cumberland, " "	70,814 02	"
Westernport Region,	70,118 19	"
Total,	201,053 01	"
To same time last year,	186,676	"
Increase,	14,377 01	"

PARKER VEIN COAL COMPANY.

The explosion of the Parker Vein Company, so long anticipated, has at length taken place, and is most extremely disastrous, both to characters and fortunes. The reputation of the Company, since it appeared in New York, has never been that of a legitimate mining enterprise, and it would be very difficult to show anything valuable to mining enterprise which has been gained by its existence. The history and progress of the Company is described, with much detail, by the Editor of the *Cumberland Miner's Journal*, from which we gather the following facts:—

The Company was chartered, by the Legislature of Maryland, on the 2d of February, 1850, with a capital stock of $500,000. By an act of the Legislature, passed on the 31st of May, 1852, the Company were authorized

to increase their capital to one million of dollars. The lands at this time held by the Company were those known as the "Barrallville lands," on Jennon's Run, limited by the charter to 8,000 acres. The proprietors, certain citizens of Boston, very soon found it advantageous to sell out a portion of their interest to certain gentlemen of New York. By this means, a new Company was formed, the Bostonians putting in the land at $500,000, and the New-Yorkers taking $500,000 of stock, at $40 per share, thus creating a working capital of $200,000. About this time, the stock was introduced at the New York Board, and, by adroit management, was run up to $78 per share. The Bostonians very wisely took advantage of the occasion and sold out their stock, thus really making a "splendid thing" of it. In this way, the Parker Vein passed into the hands of New York holders. Things went on prosperously for a time, when it was discovered that the "Barrallville lands" were entirely destitute of the "big vein" coal, which, about that period, became famous in the North. It was, therefore, determined to apply to the Maryland Legislature for an increase of capital, with the view of purchasing additional lands. This was accordingly done, and on the 11th of February, 1853, an act was passed, of which the following was the first section:—

"*Be it enacted by the General Assembly of Maryland*, That the Parker Vein Company be allowed, and they are hereby authorized to increase the capital stock of said Company, to an amount not exceeding three millions of dollars, to be divided into shares of one hundred dollars each."

The Company then proceeded to issue the additional stock, having, about the same time, purchased a large body of valuable lands in the George's Creek Valley, including the Totten, Caledonia, Jackson, and other properties. Very soon, however, a serious disaster befell the stock operations in New York. A large holder of the stock, and the upholder of the Company, had hypothecated his certificates for certain heavy loans. Upon pay-day he was not prepared to meet his obligations with promptness, when his large amount of collaterals was thrust upon the market by his merciless creditors, and down came Parker Vein stock with a rush! It never recovered from that catastrophe, but, after fluctuating for a time, gradually descended lower and lower, until hope of its resuscitation was very feeble. The stock was abundant, and sold at low prices; and, in this way, it soon took rank as one of the leading "fancies," and thus became generally distributed throughout the land.

In the mean time, the Company went on to pay large sums for their new purchases in George's Creek, and to construct the necessary mining improvements at a heavy expense. Coal, from their new property, was introduced into market; and a line of steamships was built by the Company, and put on the route between Baltimore and New York. But still the Parker Vein stock did not improve. The steamships were then sold, for $350,000, to an independent company—$50,000 cash, and the balance in the bonds of the Company. The Caledonia tract, of 353 acres of magnificent big-vein coal, was also sold to an independent company, at $1,000 an acre. By these sales, it was hoped the rest of the property of the Company would be released from debt, and the stock thus made to appreciate in the market. Still the stock did not rise. The stockholders at length became dissatisfied with the existing state of things, and arrived at the conclusion that, by removing the old board of directors, and electing one in favor of reform, an improvement might be secured. A few of them, accordingly, went to work quietly to obtain proxies, upon which to vote at the approaching annual election. They were eminently successful, so far as the amount of proxies was concerned, as the sequel proved. Upon counting up the shares they were entitled to vote, they discovered, to their great amazement, that they were entitled to represent 33,298 shares, or 3,298 more than the capital stock of the Company. This was the first knowledge the world had of the over-issue, variously estimated at from ten to thirty thousand shares, and this caused the explosion of the concern,

which has electrified Wall street, and reverberated among the Alleghany mountains.

Armed with this immense supply of authority, the gentlemen to whom we have alluded came to Cumberland to attend the annual election. The inspectors required them to produce their certificates, as well as the proxies, and the election was adjourned. They obtained the certificates from New York, assembled a stockholders' meeting, annulled the old by-law requiring three inspectors, and added four new ones to the three selected by the other party. An election was then held, and an entire new board chosen.

But, in the mean time, the old Board—the Vice-President acting as President *pro tem.*, in the absence of the President, who had sailed for Europe—had made a general assignment of all the property of the Company to trustees, for the benefit of the creditors, and the Vice-President had issued an attachment, from the Court of Alleghany county, upon a note of the Company, signed by the Treasurer, for the sum of $500,000. Thus, the matter was still more complicated. The reformers endeavored to arrest all further action of the old Board, by obtaining an injunction against them from the Supreme Court of New York. They were too late, however, for the assignment had been made and recorded, and the attachment issued and laid, before their process was served. When they subsequently, moreover, applied at the office of the Company in New York, for the books of the Company, they were informed that they had been sent to the assignees, at Cumberland. They followed them immediately, and, under a writ of replevin, broke open the office of the Company at this place, and seized upon a box of books belonging to the Company; failing, however, it is said, to secure those of which they were in search.

Thus stands the matter at present. The old Board assert that the election of the new one is illegal, for want of due notice. The new Board claim the right to investigate the affairs of the Company, but have no materials upon which to base their investigation. In the mean time, the assignees hold the property, and propose leasing the mines until the affairs of the Company can be settled by law.

We have endeavored to obtain correct information as to the condition of the Parker Vein Company, and submit the following as an approximation towards the truth:—

The debts of the Company are probably not far from the following: Due in Alleghany, for railroad freight, merchants' accounts, miners' and laborers' wages, etc., $20,000; for lands, $323,000; to H. & H. R. T. Mali, $50,000; O. P. Jewett's claim, $500,000—making a total of $903,000.

The assets are, as far as we can ascertain them, about $200,000, of the bonds of the Steamship Company, and lands in this county, which cost them originally about $500,000, and upon which they cannot have spent less than $150,000 in improvements.

This estimate includes the Caledonia property and the Steamship Company. If it is correct, and if O. P. Jewett's claim is a valid one, then the debts exceed the assets by over $200,000, without taking into consideration the stock, *which is variously estimated at from four to six millions.* The new Board have taken steps to ascertain the exact amount issued by calling it all in. What then is the value of the stock?

The Totten Property.—The contract for the title of this property is held by H. Mali, Esq., but the Parker Vein Company can force its transfer to them by paying the purchase money. It is proper that this fact should be known, in connection with the history of that unfortunate concern.

CUMBERLAND COAL COMPANY.

The following statement was prepared and submitted by the President of this Company, A. Mehaffey, to the stockholders, on the 5th ult.:—

To the Stockholders.—Since I assumed the active duties of President of this Company, I have made a statement of its financial condition, with a brief inventory of its working material, which is annexed, and have only to add, that its position is materially strengthened and its resources increased from actual business.

The business of the season opened flatteringly, with a pressing demand for our fuel at satisfactory profits. In the month of May we brought to market 28,664 tons of coal, which is the largest month's work yet done by this Company, and an increase of more than 11,000 tons, or seventy per cent. over the corresponding month of last year. I shall rapidly increase this quantity; and may remark that, with the addition of a single locomotive and twelve iron cars, which are ordered, this Company will be enabled, without any additional outlay, to mine and send to market from 2,500 to 3,000 tons per day, so soon as the public works of Maryland, now being enlarged, shall be perfected.

I anticipate the period when the market will require that amount from this Company. About two-thirds of the coal has been transported in the Company's vessels: and we have realized fair profits, not only on the coal, but on the transportation also. But the results I shall present at the semi-annual meeting will be more appropriate and satisfactory.

The advantages possessed by this Company in owning its vessels and barges, enable it to fill orders with promptness, and place it above dependence on transient vessels.

There is an increased energy in the management of the Chesapeake and Ohio Canal—the result of an enlarging trade—which must prove highly beneficial to our interests, and the interests of the coal fields of Maryland.

Such is the magnitude of our enterprise, that it has taken more time than was anticipated to complete the plans of its projectors. This delay has created disappointment; but a large proportion of our stockholders—the early and earnest friends of the Company—assured of the intrinsic value of its property and the certainty of its development, have never been disheartened. In regretting the loss of time, we must bear in mind that our works are now complete, and that, unlike other Companies, our business may annually be largely increased without corresponding expenditure.

The wisdom of the projectors of this enterprise is now apparent, in thus anticipating the wants of the country, and providing for the largest increased demand ever made upon one coal district.

Various applications have been made for the privilege of mining coal from our lands on a royalty, which would produce at the rate of not less than $3,000 per acre for the great vein alone. I have felt it my duty to decline these propositions, as realizing less than the actual value of the property. In view of the large coal estate of the Company, it may be advisable hereafter, on satisfactory terms, to adopt this method of increasing its revenue.

This Company is now earning a dividend on its capital stock, and no doubt exists as to its future prospects.

All of which is respectfully submitted.

THE LUZERNE AND SHAMOKIN COAL REGIONS.

The facilities for transporting coal to market from the Luzerne and Shamokin regions are on a most extended scale, a brief outline of which, furnished by the Editor of the *Pottsville Register*, will be found of value in connection with the facts stated on page 93, Vol. II.:—

The Luzerne region will shortly have the advantage of an opening to the whole of North-western New York; first, by the North Branch Canal to Waverly, which connects with the principal canals of the Empire State; and next, by the North Pennsylvania Railroad, leading in the same direction. There is also a route surveyed for a railway, from Wilkesbarre to New York City, which is pronounced feasible, and will most likely be built in a few

years. Then there is a road already contracted for, from Wilkesbarre down as far as Bloomsburg, on the Susquehanna. Here are four new avenues for our friends above, which fully warrant the preparations they are making to participate more largely in the coal trade.

The improvements in the Shamokin region are even more extensive than those of Luzerne.

1st. There is the Sunbury and Erie Road—the early completion of which, since the city subscription, is rendered certain—connecting with the Philadelphia and Sunbury Railroad at Sunbury, which road, in eighteen miles, leads directly to the mines.

2d. The Susquehanna Railway—a good portion of which is already graded, and, by the charter, is to be finished in 1855—connects also with the Philadelphia and Sunbury Road at Sunbury—thus forming an unbroken line to the City of Baltimore.

3d. The Danville Railroad, running from Sunbury to Danville—which latter place already consumes over 200,000 tons of coal—we have it from reliable authority—has been definitely determined upon, and will be completed in a short time.

4th. The Coal Run Railroad, under construction, connects the Philadelphia and Sunbury Road at its eastern terminus (in the heart of the region), and intersects the Cattawissa and New York Railway, thus forming a chain of railroad to the City of New York.

5th. The Mine Hill Extension, designed to connect with the Philadelphia and Sunbury at Ashland, in this county, forms a through line to Philadelphia. This work, we understand, is progressing as rapidly as possible.

In anticipation of the opening of these lines, we see ample reason for the most thorough development of the Shamokin region. The enterprising individuals, at the head of affairs there, evidently appreciate the prospect before them. Their operations are intended to be of a magnitude commensurate with the carrying facilities enumerated.

The Big Mountain Company, for example, whose annual report is now before us, though a year has scarcely gone by since its organization, have already a colliery of five gangways in working order, capable of producing, it is said, 200,000 tons per annum. Their coal-breaker, nearly completed, is represented to be one of the largest in the State, with capacity sufficient for preparing 15,000 tons annually. Their lateral railway, one and a quarter mile long, finished to the Philadelphia and Sunbury Road at Shamokin, and now in use, is substantially built of 40lb. T rail. These improvements, with a large steam saw-mill, and quite a number of comfortable houses for the miners, to accommodate enough to carry on the works, cost, the President of the Company says in his report, but $45,000—a small expenditure of money considering the quantity of coal that the improvements will enable them to produce.

The extent of the Company's estate is no less worthy of a passing remark, in this connection, than its development. It embraces some 6,000 acres—2,000 acres of which are richly underlaid with anthracite, and the balance is timber land, covered with a heavy growth of pine—a desideratum that we of the Schuylkill region know how to properly estimate. The tract lies contiguous to the town of Shamokin. Its mineral resources, above water level, of easy access, are inexhaustible, and can, it is said, be opened with advantage at several points, thereby enabling the Company to establish other collieries than the one mentioned.

Though we cannot speak with the same degree of certainty of the developments in the Luzerne region, still, it is more than probable that operations, as important as that just alluded to, are under way.

The above facts, if they demonstrate anything, show that, in a few years, the production of coal will greatly exceed the annual average increase. In the Luzerne and Shamokin regions we will have auxiliaries of great capacity

to assist in supplying the rapidly growing demand. Every fractional increase in population and business calls for an additional production of fuel. We, therefore, need feel no uneasiness at the progress of our neighbors. The field before us is vast—so great, indeed, that all can be profitably employed in occupying it.

In addition to the foregoing, the following statement of the appearance of the coal in the Philadelphia market, is of interest:—

Some eighty-five tons of excellent anthracite coal arrived here on board a canal boat, lying at one of the Delaware wharves, between Market and Arch streets. It is from the mines of the Big Mountain Coal Company, located about a mile and a quarter from the town of Shamokin, whence it was shipped by railroad to Sunbury, and taking the canal route down the Susquehanna, reached the Delaware by way of the tide-water canal, and so came up the river to Philadelphia. This is a roundabout way, but it is the only available avenue of trade yet opened to these mines. The Mine Hill Extension Railroad, however, will be finished early in July, and when the Philadelphia and Sunbury Railroad is completed, will open a superior communication with Philadelphia. Other lines of railway will hereafter open these mines to the markets of New York and the West. This is a Philadelphia enterprise, many of our most substantial merchants being among the stockholders. The Company's lands are entirely underlaid with anthracite coal of a very superior quality. That shown to us, is fully equal to the best anthracite in the market. It is said to be peculiarly adapted to the generation of steam and the manufacture of iron. The veins are ten in number, and vary from five to fifteen feet in thickness each. They contain millions of tons of coal above the water level, and being easily worked, their product can be delivered at various markets at prices which will compete successfully with other coal mines.

MINERAL WEALTH OF ALABAMA.

A correspondent of the Mobile *Advertiser*, speaking of the North-east and South-west Alabama Railroad, says:—

It will aid materially in the development of the mineral resources of Alabama. The locality, extent and variety of these resources cannot be known with much accuracy, in advance of the geological survey of the State, which was wisely provided for at the late session of the Legislature. But, from the partial explorations which have been made, it may be safely assumed that coal and iron are by far the most abundant, and from their quantity, the most valuable of our mineral deposits.

The coal fields of Alabama embrace, according to several authorities, an aggregate area of over fifty-five thousand square miles. They are divided by their localities into two great sections, known as the Warrior and Cahaba Valley coal fields, the former being more than twice as extensive as the latter. In each division, iron ore of a superior quality and in great abundance is found in close proximity with the coal strata. From their locality, the topography of the country, and the demands of trade, the Cahaba coal fields will find their natural outlet to market in the direction of the Atlantic seaboard, and they may consequently be said to be commercially tied to Pensacola or some Atlantic port. With the Warrior coal fields the case is reversed. They are excluded by the same causes from Atlantic markets and find their proper outlets upon the Gulf.

Now, it is a fact familiar to the industrial economy of the age, that the value of coal and iron, as articles of commerce, depends materially on the cheapness with which they can be transported to market. The one being a bulky and the other a heavy article, and each entering largely into general use, only when furnished at low prices, they cannot bear the cost of haulage over dirt roads or even of carriage by ordinary water craft, except for very short

distances. Hence canals and railroads are indispensable agencies for the profitable mining of coal and iron in insulated sections of country, and the construction of the former, with termini at suitable markets, leads invariably to the development of the latter. Thus it is a well known fact that the coal and iron mines of England, and of many portions of the United States, were comparatively valueless, until outlets to market were constructed, in the former at a cost of hundreds of millions of dollars, and in the latter at an expense which, in many instances, seemed reckless until the abundant dividends resulting from the stimulated production of the articles sought to be transported proved the wisdom and safety of the improvement. But illustrative examples are entirely unnecessary to prove the point. The whole history of coal and iron mining in this country and Europe, shows that it can be profitably carried on, only in connection with cheap, safe, and speedy channels of communication to market, and that where these exist by the bounty of nature or are opened by the industry of man, the business becomes at once and permanently remunerative, provided there be a supply of mineral deposits in the locality selected, and ordinary skill and prudence be employed in mining and selling them.

ON WORKING COLLIERIES.

To the Editor of the Mining Magazine:—

Dear Sir—Having, in my former contributions to your valuable work, alluded to the *long-work* system of mining coal, I beg to offer observations on it. The Report of Mr. Smyth to Parliament, lately, gives the information that the system is at last established in the 30-feet coal-seam of Staffordshire. It is also now the mode at the deepest shaft of the north of England, Messrs. Pemberton's, and others.

The Report alluded to states, truly, that it has been so for centuries in Derbyshire (my native county) and Shropshire, England. The coal-seams of the Far West being chiefly of moderate thickness, and inclination suitable for, and (on account of economical working) requiring long work, I shall notice any point which I believe will lead to a just idea of the advantages of the system. Instead of the loss of, say, one-third the area of the seam, in pillars, to support the incumbent strata, the seam is taken entirely out, by long faces of work, called "banks." Strong pillars support the branch roads (from the main road) temporarily, which are worked returning, when other more inward roads are in position to take up their office. The main road may be considered what is here termed a "gangway," but the branches from it, "few and far between," leave it strong and permanent.

These long faces, or banks, are from 150 to 500 feet, according to the strength of the roof and floor. Where these allow of a road for the coal of inner parties of men to pass between the props and an outer party at work, they may be 500 feet or more, and every 100 feet have a party, as that width will give the party their "day's work." And, next day, the party inward of them takes the "end," or "buttock," they left off at, and they take that of the party outward of them. At the three collieries of my father, to the management of which I was brought up, the roof did *not* admit of more than one party of men in each bank sending out coal. The undermining was chiefly done by night, to the depth of three feet, more or less (as found best suited to the "back" joints of the seam), at about twelve cents per superficial yard.

The pressure of the strata, called by the miners the "big hammer," in a great measure, brought down the undermined faces of coal, to the great

saving of labor and powder, and causing the coal to break up by its natural grain joints and slips, produced it with a far less proportion of *small*, which, in the splint and cannel coal-seams, was nearly unsaleable, and seldom landed from the mine, even by use of rake and basket.

The props being two ranks, the back one moved to front nightly, as the face progressed, and as near to it as convenient. The weight upon those props was merely a *lip* of the roof, between them and the face; for the great width of the worked ground, behind the props, termed "the waste," allowed of its *breaking*, or *subsiding gradually*, so that the weight of the upper strata rested on the floor, and became *easy*, affording no lodges for accumulation of foul air. The ventilation was by the whole body of the air along the face of the works, *through* one face to another, from shaft to shaft, with doors on the branch road of each bank; one, to shut behind a train of cars, before the door in advance of it opened (which can easily be done by the driver with lines). Explosions never occurred in our workings, except a few times by neglect in headings, ventilated by pipes, to unwater new pits, by boring. In the three-feet splint seam of Lings, near Chesterfield, the roof being good, knogs of wood, placed on a heap of small coal, formed the props, and would endure for years. To take out a pack of these from between others, the compressed small coal was picked out from under the lower knog, and the pack fell, and was re-set in front.

At the Tupton Colliery (of tender roof and floor), props set closely together, of tough wood, were found best, as they sunk in the floor, and allowed the subsidence of the roof, and were easily drawn from the holes they had made by chain and lever-bar, after the top was set free. The modes of bringing down the long faces of undermined coal were many, according to its strength, texture, etc. If jointy, the "hammerman" would simply precede the loaders or landers of the coal; but if it was of such solidity as required great labor and art to bring it down, the hammerman must nearly accompany the night-underminers of it, and cut holes in the upper part of the face, as far in as the "back-crack," or parting; deepen the undermining if necessary, by his own labor, or by allowance to the holers; set wedges right and left in the hole, next to the end, and in the said back-crack; but as soon as the sound of his wedges told that the coal had *started*, he ceased to hammer, and, going along the face, repeated the operation, leaving the started coal to assist to bring down the rest.

At our Norbriggs Colliery, less than thirty or forty yards of the face could not be hammered to advantage at a fall, and when opening on a corner, or angle formed by the level, making an angle of 23° with the face or back parting of the seam, half the coal would be lost, as small; and as the narrow width would not allow the roof to subside gradually (but it hung for days or weeks on the end pillars of coal), when a press of roof occurred, the props along the face would be broken or forced out. In other words, the splint and cannel coal, if deep and strong, or free from end joints, is scarcely workable, except by *long-work*.

Having been called to advise on long-work at Coltness Iron Works, near Glasgow, Scotland, the seam being only sixty feet deep—coal jointy, as bricks in a kiln—I advised them to continue stall work, and get the pillars on the return. I introduced degrees of long-work, as best suited to the seams of coal and ironstone, at many mines in Wales. With respect to danger for workmen, I shall state that, during twenty years, there was only one man killed at the said three long-work collieries of my father, at work along the banks or face of the coal; and that I have managed works, for forty years, employing from 300 to 600 men, and not one miner killed in his own place of work. The injuries to the farm-men of a small village, near our three works, far exceeded those at the colliery, employing ten times as many persons, although we had all the difficulties mentioned to contend with. I have since found the fan, invented at the Worcester Foundry,

England—only twenty inches diameter and five wide, driven by a wheel twelve feet high, over which a small cord ran to another only three inches diameter, on the axle of the fan, having 1,500 evolutions—very useful for ventilating headings, in advance of main workings. The great difference in the systems of mining coal in Britain and this State is, that, here, almost every shaft or slope is a new "foundation," with its engines, etc., etc., and costly sinking under pumps; but, in England, one foundation, by headings, hollows, say, fifty subsequent coal-landing shafts, bored and sunk at about five to ten dollars per yard. The number of openings at Pittston, in this State, would astonish the oldest coal-master of Britain.

By long-work, we took all the coal of a six-feet seam from under steam-engine stacks fifty feet high, and wells of water only one hundred feet above the seam, without injury to the stacks or loss of water, so little does long-work dislocate the strata or surface. It has been usual to pay the miners of this State the pit price per car, *with* a price *per yard*, in gangways, varying from a dollar to three, per yard. It is certain, that such has been the neglect of airing the gangways (ahead), that they would have made as much money *without* the price per yard, had they had *good air*. Where the seam would not allow of a twelve-feet wheel to the fan, two of six feet, and a small one, would give the same evolutions, and be quite portable. A flexible tube would be brought out by the miner, when a shot was to be fired, and twenty turns of the fan send out the smoke and foul air to the main current.

Though we see, generally, ten-horse engines to blow at foundries, two old fellows leave cleaning castings, and in the afternoon, by the Worcester fan (of ten dollars' cost), melt three tons of pig iron for castings, having coke for the cupola; anthracite requires more blast. I have two of these fans, and steam-engine, etc., etc.

Yours, respectfully,

T. Butler.

Beaver Meadow, Penn.

COAL TRANSPORTATION BY RAILROAD.

This is an important point in determining the value of coal mines, owing to the influence it has upon the price when the coal reaches market. We have not investigated the subject more than to a limited extent thus far, preferring to wait until many of the roads now in construction for this purpose, shall add their experience to the list. Coal, at present prices, is regarded as a very profitable freight, and it may be said to be the observation of dealers, that increased facilities of transportation have not, as yet, effected any material reduction of price to the consumer. We insert the annexed statements as bearing upon this general subject:—

A great principle in the philosophy of railroads has been left heretofore to develop itself, and in spite of the economy which it embraces, it has been accepted only so far and so fast as was necessary to do the business which has been *forced* upon our roads. This principle is that of the "concentration of locomotive power." It is well known that the prices of wages and of materials used in operating railroads are from fifty to one hundred per cent. higher now than ten years ago. Yet it is equally well known that the operating expenses of large roads, such as have supplied themselves year by year with the current improvements of the times, are less per ton or per passenger moved, now than *then*. Look at the cost of carrying coal on the Reading Road for each of the last ten years. In 1843, the cost of carrying coal from Mount Carbon to Richmond was 46 cents per ton. Under present prices of wages, fuel, and iron, this cost would be certainly 70 cents, and probably more. But the actual cost of carriage per ton has been reduced, by a gradual development of the principle we have so often advocated, until in 1853 it was

but 35 cents, or but *one-half* what it would have been under the former system. The greatest means which have effected this result have been the doubling of the capacity of the engines; so that where two hundred tons was the average weight of coal carried in one train in 1843, 400 tons are now carried.

The following are the statistics of cost of carrying one ton of coal, for each year since 1843, as by the Company's last report:—

1843	46.00 cents.	1849	43.62 cents.
1844	41.08 "	1850	40.69 "
1845	37.01 "	1851	38.54 "
1846	38.89 "	1852	35.36 "
1847	45.84 "	1853	35.07 "
1848	45.05 "		

Were the several costs adjusted upon the same prices as in 1843, the cost for 1853 would be about 23 cents per ton, or one-half of that in 1843.

In connection with the foregoing, is the statement of the *Pottsville Journal*, relative to the expenses of roads in the Schuylkill region. There seems to be a discrepancy in the statements relative to the cost on the Reading Road, which perhaps the parties concerned can explain; the former is the price stated in the Company's annual report:—

One of our subscribers has sent us a pamphlet containing some strictures on the management of the Baltimore and Ohio Road, and asks our opinion with regard to the amount charged by said road for carrying coal. We have taken some pains to make the necessary inquiries with regard to the expenses on the roads in this region, with undulating grades, and we find that the expenses rapidly increase in proportion to the steepness of the grades. For instance, a first-class engine weighing 24 tons with eight driving wheels, can only haul 20 cars laden with about 100 tons of coal, up a grade of 100 feet to the mile—30 cars up a grade of 80 feet per mile—40 up a grade of 60 feet, and 75 up a grade of 24 feet per mile, which is the grade on the Swatara Branch of the Mine Hill and Schuylkill Haven Railroad, and that is the average train hauled on said road. On the Philadelphia and Reading Railroad, the grade is descending all the way, except a dead level for several miles. The heavy engines on this road transported last year, on an average, 430 ton sper trip during the year, making from 90 to 100 cars in the trains. The large business of this road has reduced the coal transportation to a perfect system, and the rates per ton have been reduced, within the last three years, from 61¼ cents per ton, actual expenses, to a little less than 54 cents last year. If, therefore, the data is correct, that the first-class engines on the Baltimore and Ohio Railroad transport only 120 tons to each train—and the distance is nearly 200 miles, or double the distance of the Philadelphia and Reading Railroad—the following conclusions are easily arrived at:—

The actual expenses on the Philadelphia and Reading Railroad were, last year, 54 cents per ton for 95 miles, carrying 430 tons to each train.

The actual expenses on the Baltimore and Ohio Railroad last year, for a train carrying only 120 tons to each engine of the same class, must have been 3½ times greater for the same work—which would give $1.89 per ton for same distance. Now, as the distance is double from Cumberland to Baltimore, you must double these expenses, which would give the actual expense at $3.78 per ton from Cumberland to Baltimore. The rate charged last year by said Company, was $1.75 per ton—showing an actual loss on mere transportation, on each ton of coal, of $2.03. The present rate charged is $2.25. The actual loss at this rate is $1.53 per ton on the transportation. These are positive and actual losses, sustained by that Company on the most favorable comparison. As we said before, the Philadelphia and Reading Railroad Company does a very heavy business—it can transport cheaper than any railroad in the

world—it has a double track, causing but little delay on account of accidents—besides the grade is such that the wear and tear of its machinery is trifling, compared with the racking of machinery on an undulating road, where the destruction must necessarily be increased nearly twofold. And besides, the Baltimore and Ohio Railroad having but one track, which in case of accident detains the trade, and largely increases the expenses of such roads over those having two tracks. All the trade is detained on a road with a single track, in case of a break-down—but on the Reading Road the track is double, and they have also long sidlings every few miles on the route, causing scarcely any detention to the trade, in case of accidents. Besides, so racking is it to the machinery on undulating railroads, that locomotives have been known to explode merely from the change of water in the boilers, etc., in the varying grades of a road. Taking all these things into consideration, the actual loss per ton, on the transportation of coal last year, by the Baltimore and Ohio Railroad, may be safely set down at $2.25 per ton, and the loss of the present year at the present rates may be safely set down at $1.75 per ton. We fearlessly assert, from the experience of this region, that the Baltimore and Ohio Railroad, cannot transport coal for less than from $3.75 to $4.00 from Piedmont to Baltimore, a distance of 207 miles, if the locomotives of the first class only haul 120 tons to each train.

COKE FOR LOCOMOTIVES.

It is stated that the Hudson River Railroad Company made a trial of running some of its engines with coke made from Cumberland coal, instead of wood, and which proved very successful.

The use of coke will effect a saving of two-thirds the present expenses of working the engines, and is of great importance to railroad companies.

IRON AND ZINC.

THEORY OF IRON SMELTING.

A blast furnace consists of two columns, one of air, ascending from below upwards, and the other of solids, thrown in from above and descending. At the top, the amount of watery vapor is 9 to 14 per cent. But the vapor in the gases rapidly diminishes. At the top the gases are, nitrogen, 57·79; carbonic oxide, 23·51; carbonic acid, 12·88; hydrogen, 5·82. At between eight and seventeen feet from the top, the carbonic acid and hydrogen diminish, and the water completely disappears. The oxygen of the air is first changed into carbonic acid, and then, by the coal, into carbonic oxide. The hydrogen is produced by the vapor of the water, which is decomposed by carbon into hydrogen and carbonic oxide. As the column of gas ascends, the carbonic oxide diminishes, and the carbonic acid increases—a change produced by the action of carbonic oxide upon sesquioxide of iron, which yields carbonic acid and metallic iron. It seems remarkable that hydrogen should exist in contact with sesquioxide of iron, at a red heat, without deoxidizing it; but it has been shown that an electric spark, passed through carbonic oxide, oxygen, and hydrogen, produces carbonic acid, while hydrogen remains. Between the neck of the furnace and the boshes the minerals lose their moisture, and the oxide of iron $\frac{2}{3}$ of its oxygen to the deoxidizing power of carbonic oxide, while the $\frac{1}{3}$ remaining are removed between the boshes and tweens by the carbon of the coal. At a foot above the tweens, the temperature diminishes, and to this the line of fusion is limited, and here the change of carbonic acid into carbonic oxide is complete.

COMPOSITION OF THE GASES IN IRON FURNACES.

Depth from the top in feet,	5	8	11	14	17	23	24	34
Nitrogen,	55·35	54·77	52·57	50·95	55·49	58·28	56·75	58·08
Carbonic acid,	7·77	9·42	9·41	9·10	12·43	8·19	10·08	—
Carbonic oxide,	25·97	20·24	23·16	19·32	18·77	29·97	25·19	37·43
Carbonic hydrogen,	3·75	8·23	4·57	6·64	4·31	1·64	2·38	—
Hydrogen,	6·78	6·49	9·38	12·42	7·62	4·22	5·65	3·18
Olefiant gas,	0·43	0·85	0·95	1·57	1.38	—	—	—
Cyanogen,	—	—	—	—	—	trace.	trace.	1·34

The occurrence of cyanogen is interesting, although its formation had been long ago pointed out. When an iron tube was introduced through a hole two feet nine inches above the hearth, a gas passed out burning with a yellow flame, similar to that occurring during the preparation of potassium. The tube was soon obstructed by cyanide of potassium. The cyanogen is produced by the nitrogen of the air or coal, while the potassium is derived from the potash of the coal (.07 per cent.), and from the iron ore (.75 per cent.), amounting to 270 lbs. in twenty-four hours. The cyanide of potassium is volatilized, and is decomposed by the air into carbonate of potash and cyanide, which is gradually decomposed as it ascends. That the cyanogen is not altogether decomposed is, however, proved by the results obtained at Coltness iron works, where, in saving the waste gases for the purpose of calcining the ore, a considerable quantity of alkali, containing cyanide of potassium and carbonate of potash, is sublimed in the common furnace at the summit. The amount of alkaline salts sublimed may be about two and a half tons per furnace during the year.

METALLURGIC TREATMENT OF IRON.

A great proportion of the expense incurred in the metallurgic treatment of the ores of iron is occasioned by the large quantities of combustibles consumed, and it is consequently of the highest importance to reduce, as far as possible, this expenditure of fuel. For this reason, it is usual to increase the weight of the charges of ore, until the metal produced suffers more from deterioration in quality than can be gained by economy of the combustible, and the working of the furnaces will, therefore, be most advantageously conducted when these limits are most nearly approached. The fuel employed in the blast furnace is either charcoal, coke, or coal, and the nature of the products obtained will be in a great degree influenced by the nature of the combustible with which the apparatus is kept supplied. When charcoal is the fuel used, the amount of incombustible matter produced is very small; and, besides being extremely fusible, it does not contain any ingredient detrimental to the quality of the iron manufactured. In furnaces, therefore, in which charcoal is consumed, the problem sought is the formation of the most fusible slags which can be produced; and great care is at the same time taken to exclude from the charge any impurities likely to exert an unfavorable influence on the properties of the metal obtained. The slag resulting from this method of treatment is a nearly pure double silicate of lime and alumina, containing but slight traces of protoxide of iron, and in which the oxygen of the acid is just double that of the united bases.

With coke, on the contrary, the amount of ash left is often considerable; and as the fuel frequently contains sulphide of iron, resulting from pyrites present in the coal from which it was made, the sulphur thus introduced into the furnace unites with the iron produced, and materially affects its quality. If, in this case, the mixture of ores were arranged so as to again give rise to the formation of a double silicate, having the same composition as that obtained in the charcoal furnace, a large proportion of the sulphur present would unite with the metal, thereby greatly deteriorating its quality, and totally unfitting it for the majority of manufacturing purposes.

Experience has shown, that when an excess of lime is, under these cir-

cumstances, present in the furnace, the sulphur no longer possesses a tendency to unite with the iron, but passes off in the slags in the form of sulphide of calcium. The slag resulting from this method of operating, instead of being a double silicate, in which the oxygen in the base is but half that contained in the acid, will form a silicate in which the oxygen of the base is equal to that of the acid, and is, consequently, more infusible than the slags produced by the chacoal furnace, and therefore requires a very high temperature in order to coax it to flow freely from the hearth. The metal manufactured by the use of coke is usually of inferior quality to that obtained from furnaces where charcoal is employed; but the great expense of the latter fuel causes it to be applied only where iron of the best sort is required.

EUREKA IRON COMPANY.

The Eureka Iron Company, A. R. Harlow, Agent, have just completed their saw-mill, and will be cutting lumber in a short time—have about 2,200 saw logs on hand, and plenty of suitable timber for more close by. If the season should prove favorable for sawing, they will have a large amount of lumber for sale. They have raised upwards of 100 tons of iron ore from the ore bed, only a few rods from the saw-mill. They have recently discovered a new bed of ore, or rather a continuation of the same bed or vein,—thus confirming the previous supposition, that there is enough of it. This Company will build a blast furnace this season. They have cut about 1,500 cords of wood, which will be made into charcoal soon.

Commenting on these particulars relative to the progress of the Eureka Company, the *Detroit Tribune* adds the following. Other facts will be found in Vols. I. and II. :—

The Eureka Company is composed of some of our most enterprising and wealthy citizens. We have already given a description of the extensive and valuable purchase they have made at Wyandot, ten miles below this city. We understand that on Monday the Company commence the construction of the necessary wharves for prosecuting their new enterprise, houses for workmen, furnaces, etc. They are to begin operations on the most extensive scale, having both capital, enterprise, and experience at their command. The point they have selected is in every respect admirably adapted for the purposes of the Company.

IRON REGION OF LAKE SUPERIOR.

A writer from Carp River, the location of many iron companies of that region, thus describes the progress of their operations :—

Last season, the Cleveland and Sharon Iron Companies shipped 900 tons of blooms, and 500 of the ore. This year, the same Companies will ship about 2,000 tons of ore exclusively, and the Cleveland Company about 70 tons of blooms.

The Lake Superior Iron Company, under the supervision of Hon. H. B. Ely, have not done much, since last fall, toward completing their railroad to the mountains, but it is confidently expected that Mr. Ely will be on hand with a large force, and resume the work with energy, as soon as navigation is fairly open. It is probable that this road will be completed by another spring; a great deal of the grading and other work has been done, and some part of the road may be put in operation before next fall.

The Cleveland Iron Mining Company, Dr. J. J. St. Clair, Agent, have hauled down ready for shipment, about 1,200 tons of ore. They have, also, ready to ship by the first boat, about 70 tons of blooms (manufactured just previous to the burning of their works in December last). This Company have just completed the survey, and are now making active preparations to

build about three miles of plank road, commencing at the terminus of the Sharon Company's road (at the Jackson Iron Mountain), and extending to the mountains beyond. They have on hand upwards of 1,200 cords of wood—have built during the past winter, and are now building, about 20 new dwelling-houses. They are tearing down and obliterating all of the old log dwellings, erected by the first comers here, in 1848 and 1849. Streets have been laid out, and the land divided up into village lots, which are selling rapidly at fair prices. The Company have nearly completed a new, large, and commodious store.

The Sharon Iron Company, David Himrod, Agent, have employed a small force getting down ore. They have but about 800 tons down, which they design for their own works at Sharon, Pennsylvania. Their main force they have kept at work at every available point on their plank road. They have pushed this work with an energy that deserves commendation. They have already graded, at different points of the road, a little over half the distance to the mountains, including the heaviest and most difficult of the grading.

This Company have let the contract for building an unusually large wharf and breakwater, at the north end of the harbor. The contractors have been, for some time, actively engaged in getting out the necessary timber for this work. The Company have constructed two forty-foot crane-scows, to use in boating the stone and timber to the spot. These scows are to be towed by another smaller scow (which is nearly completed), propelled by a horse-power, by means of a stern paddle-wheel.

Another two years, and this place will ship its hundreds of thousands of tons of iron ore.

The Collins Iron Company, R. J. Graveraet, Esq., Agent, are making active and well-directed preparations to build a forge, etc., on Dead river. They intend to manufacture into blooms on an extensive scale. They have an extensive water-power, and a large and valuable body of coal and pine land, and immediately adjoining the water-power. This Company are also the owners of some very valuable iron lands, in the vicinity of the Jackson Iron Mountain. Their works on Dead river will be about two miles from either the rail or the plank road. With a small expenditure they can build a branch plank road to connect them with either of these roads. With the great facilities this Company already possess, the manufacturing of iron, at present prices, cannot help proving very profitable, if properly managed.

McConnell and Company's Iron Works are also on Dead river, about two miles above Collins and Company's place. They have got down to their place, a considerable quantity of iron ore during the past winter. Their forge is not yet completed—as they have, since January, commenced, and now almost finished, a good saw-mill, which they will have in running order in a few days. This will greatly add to their facilities for building their forge and other necessary buildings. This Company purchase their ore of the Jackson Iron Company, at their mountain.

HAVERSTRAW MINING AND IRON COMPANY.

The property of this Company was noticed on page 220, Vol. II., with a report of an assay of the ore: further particulars are contained in the annexed paragraph:—

The mine is situated thirty-four miles from the city of New York, only five miles from the tide-water of the Hudson, and six miles from Grassy Point Landing. A majority of the stock is already subscribed and a portion paid in. The immediate objects of the Directors are to mine and deliver their ore at the river for sale, and to erect furnaces for the manufacture of blooms direct from the ore. The furnaces are being erected on a small tract of land of about twenty-four acres they have bought for that purpose near the river. Already some 5,000 to 8,000 tons of ore have been raised, and the settling of the roads

is only awaited to transport that to the wharf for sale. From twenty to thirty men are constantly employed in mining, and more will be put on as soon as the demand for the ore will justify it. The furnaces *now* to be built are intended to be capable of producing 500 tons of bloom per annum. The erection of them is in progress, and a portion of them intended for operation by or before the 1st of June next. The deposit of ore is inexhaustible for generations. The cost of mining and raising it, from the experience already had, is below *fifty* cents per ton, and contracts are offered for hauling it to the wharf for *one dollar*. It is estimated upon careful data that the ore can be delivered at the river, *all expenses* of superintendence, etc., *included*, at a cost not exceeding *two dollars* per ton. The Directors have the construction of a railroad, to connect the mine with the river, in contemplation, which will reduce the transport of the ore to the works and the wharf *fifty* per cent. Applications have already been made that warrant the expectation that *all* the ore that can be delivered at the river, by the means at control of the Company, can be sold at not less than *four* dollars for the ordinary quality, and the richer vein referred to in the annexed letter is estimated to be worth 25 to 50 per cent. more—the cost of mining which will not exceed that of the ordinary.

At the present ruling prices, cautious and reliable estimates show that iron in blooms can be produced and sold at a corresponding profit, thus affording a margin for a heavy decline, and yet pay fairly on the investment.

The contiguity of the mine to the New York market, the superior quality of the ore, the great and growing demand for such ores, its location so near the free navigation of the Hudson, and the economy with which coal can be delivered at the works, all give assurance that it is one of the most valuable iron mines in America, and it is believed the stock of the Company promises returns affording one of the best opportunities for investment of capital now before the public. A portion of the capital will be withheld until it shall be decided to construct the railroad. The greater portion of that required is already subscribed.

GRAND TOWER IRON WORKS COMPANY OF MISSOURI.

The property of this Company is located in Missouri. From a report upon the same by Dr. King, of that State, we derive the following facts:—

These lands are situated in the State of Missouri, in fractional township 34 north, range 14 east of the fifth pr. meridian. They are bounded by the Mississippi river on the east, and extend back about one mile. Along the river front they are chiefly an alluvial level, well adapted to agricultural purposes. A large portion of this alluvial plain, on survey No. 364, is entirely above all overflow; a portion of some of the other (as on surveys No. 2,130 and 2,173) was submerged by the great floods of 1844 and 1851, but these, it is well known, were extraordinary occurrences, and may not take place again for many years. The country back rises to a high ridge, probably 150 or 200 feet above the average level of the Mississippi river. Two small streams or ravines, generally dry except in very wet weather, have their origin in this ridge by many heads, which cut up this high land into numerous ridges and intervening ravines. The main ridge assumes, consequently, a semicircular form, with one of its extremities projecting to the Mississippi river, opposite the Grand Tower; and the other, near the dividing line, between the surveys No. 2,173 and 2,130.

The ravines and their tributaries, cutting deep into the rocky strata, afford favorable opportunities for studying the position and character of the strata.

The country is generally well timbered with oak, beech, hickory, gum, etc., and will afford a large supply of vegetable fuel for smelting and other purposes. Taking the hills, ridges, and valleys together, they will average about sixty cords of wood to the acre, adapted to the manufacture of charcoal. There is a large area of territory contiguous to the country I exam-

ined—some of which is yet public land—of the same character; and hence, a supply of this kind of fuel, at a fair price, may be relied upon for a long time. On the opposite side of the river, the great alluvial plain of the Mississippi river, known as the American Bottom, spreads out some five or six miles in average width, still more densely covered with its primeval forest; and, as the progress of cultivation and improvement extends, will afford an additional source of supply of this material.

Limestone abounds in all the hills and ridges, and, consequently, can be had in any quantity that may be required for building purposes, or for the uses of the furnace in smelting, upon the most economical terms. Sandstone can also be had at convenient places on several of the hills of the vicinity, and on the opposite side of the river there is a large ridge, immediately on the bank, composed exclusively of this material, from which it can be had with the greatest facility.

But the main questions for solution were the quantity and quality of the iron ore itself, and to these was given all the attention that circumstances and their importance demand. The season—the middle of summer—is not a favorable time for minute investigations into the mineral deposits of a country covered with vegetation, where scarcely any explorations have yet been made. Under these disadvantages, it was of course impossible to see all the indications which the country may present. At one or two points, the ore-bed had been recently opened, but this only for a very limited extent, and, consequently, information had to be sought in its outcroppings on the hill-sides, and in the debris along the flank, and in the ravines.

At the point on the north-west fr. qr. of the south-east qr. of section 19, where this slight exploration was made, the bed of ore appeared to be at least three to five feet thick; but the exploration had not yet been carried far enough to determine this thickness to be the result of one bed or two. I was informed by the miners that this deposit rested on a thicker vein below, but which was covered by the debris at the time I examined it. In some other places there were indications of two beds, near each other, and this may have been the case here. This deposit I traced on the same side of the ridge, by its outcropping at various points for about one hundred yards, and it is very probable it will be found much more extensive by practical operations. That it passes in the form of a stratum or bed entirely through the ridge, I have little doubt, for I found the same ore in large quantities in the ravine on the other side.

The amount of ore found in these ravines indicates that the deposit must have been originally very large. It constitutes a large portion, sometimes fully one half of the loose materials found in these ravines, and in masses that often will weigh from one hundred to one thousand pounds. Their flattened, and almost always nearly parallel surfaces, show these masses to have been portions of a regular bed. Throughout almost every ravine in the western part of Henry Riley's grant (survey No. 364) and the fractional north-west quarter of the south-east quarter of section 19, this debris of iron ore showed itself in the ravines and on the hill-sides. We are therefore fully justified in believing that the bed itself, as it was originally deposited, will be found *in situ*, in the hills between these ravines. But it is not at all probable that it is confined to this area. Some years ago I made a survey of the lands belonging to the St. Louis and Birmingham Iron Mining Company, some four or five miles south of those now under consideration, and I now find from the geological character of the country, that there is little doubt of the existence of the same deposits of ore throughout the whole intervening region.

The quality of the ore is a subject upon which a positive opinion can be given. The practical iron worker, as well as the scientific mineralogist, will pronounce it at first sight to be of the finest quality of its species—brown hematite, or hydrated brown oxide. In its original condition it is found to yield more than fifty per cent. of pure iron by analysis; and after having been

roasted to expel its combined and hygrometric water, it will yield in the furnace, in the large way, near sixty per cent. of pig metal. It contains neither sulphur, phosphorus, arsenic, copper, nor other foreign material of a detrimental character, and therefore may be made either into forge or foundry pig of the best quality, as circumstances may require.

Although it is not strictly within the range of my operations, in this case I cannot refrain from calling your attention to the importance of this location for iron works, as connected with the coal beds on Big Muddy river in Illinois. Although there is a supply of vegetable fuel on and near these lands, that may be relied upon for many years, at moderate prices, yet if it should be an object to carry on *very extensively* the manufacture of iron in all its forms at this point, it would be an object of the highest importance to have mineral fuel (coal) equally accessible. This is fortunately the case. The coal of the Big Muddy river is bituminous, and of an excellent quality for using either in its raw state or for the manufacture of coke. The late Professor W. R. Johnson—than whom there could be no better authority—ranks this coal with the Midlothian (Virginia) and Liverpool orrel, and containing only 3·56 per cent. of earthy matter (cinder or ashes). In this latter respect, its very small per centage of earthy matter, it is peculiarly adapted for furnace purposes, particularly as it has been found (by the analysis of Professor B. Silliman, jun.,) "to contain no trace whatever of sulphurous matter."

A railroad line has been surveyed from these mines to the Mississippi river, at a point nearly opposite to these iron lands now under consideration, and the distance found to be $13\frac{89}{100}$ miles, and it has been found, by careful calculation of its cost of construction and working the mines, that this coal will yield a fair profit when sold at five cents a bushel on the river bank. There is but little doubt, therefore, that a Company, engaged in the manufacture of iron, could, by owning their own mines and road, deliver it at their works at a much less price. I have never examined these coal mines, but have been informed, on reliable authority, that the stratum or bed is from five to seven feet thick, nearly horizontal, in the bluffs of the river, easy of access, and affording every facility necessary for working them to advantage.

PREPARATION OF ZINC AT THE VIEILLE MONTAGNE.

The ores treated at Vieille Montagne are mostly carbonates, oxides, and silicates of zinc. These ores, when first brought to the works, are largely contaminated with clay, and other earthy matters, of a less specific gravity than the real ore itself, and these earthy matters are sometimes removed by a very economical process, although it occupies a considerable time. The ores are in the state of lumps allowed to remain for several months exposed to the action of the weather, when the earthy particles get washed away by the heavy rain. But, to facilitate the operation, a stream of water is sometimes allowed to run upon them. After this mechanical operation, the ores are sorted into two classes, according to their physical and chemical characters. The first class comprises those which contain little iron, and are called "white ores." The second class takes in those which contain most iron, and are known by the name of "red ores;" the color, of course, being due to the presence of oxide of iron. The ores, after being thus sorted, are calcined in kilns, similar in shape to those made use of for burning lime. Here the water and carbonic acid are driven away, causing a loss of about 25 per cent. After this operation the ore is ground very fine under large rollers, and is passed through very fine sieves, when it is ready to be reduced. The reduction of the ores is conducted in large cylindrical retorts, measuring 3 feet 8 inches long, and 6 inches diameter inside. Forty-two of these retorts are arranged in one furnace, four of which are formed out of one mass of brick work. To the mouth of each retort is fitted a cast-iron conical adapter, 16 inches long; to this again is attached a wrought-iron tube, tapering outwards till the bore is

only half-an-inch. About 1,100 pounds of calcined ore and 550 of coal constitute a charge for the 42 retorts, being 26 pounds ore and 13 coal for each retort. When the charge has been introduced, the heat is gradually raised till it attains a bright white. When the retort has become very hot, carbonic oxide begins to make its escape, and burns with its characteristic blue flame at the point of the adapter of cast-iron. When reduction commences to take place, a greenish-white flame issues from the tube and volumes of white fumes. At this point the conical wrought-iron tube is luted on, and the fire is kept up for about two hours, when the conical tube is removed by a pair of tongs, and passed over a vessel to receive the oxide of zinc, which is rejected and fused with a future charge. One of the workmen now holds a receiver, or what they call a "Poelon," beneath the beak of the retort, while another workman rakes out into it the distilled zinc which has accumulated at the retort's mouth. This zinc is covered with a coating of oxide, which must be removed before the zinc is cast into bars. When this is completed, the cone is again luted on and another charge drawn off, in the same way, after two or three hours' firing. After the operation is finished, the residue is drawn out, which still contains a large quantity of zinc, but this must be thrown away, as it cannot be extracted from the refuse, as new compounds are formed, such as silicates. "The establishment of Vieille Montagne employs 2,646 persons, and produced 11,500 tons of zinc in 1850."

COMBINED REFINERY AND PUDDLING FURNACES.

Messrs. Talbot and Norris, of Crewe, Cheshire, England, have recently patented an arrangement, with a view to neutralize some of the evils unavoidable with the present mode of smelting. The system of running hot metal from the blast-furnace to the refinery, or to the puddling-furnace, involves much inconvenience and some injury to the blast-furnace; for adapting its contents to the continuous wants of the refinery, the smelted iron must be retained in the hearth of the blast-furnace, subjecting it to much injury; nor can sufficient control be had on the quality of the iron coming from it—the fact being now well known, that from the same class of materials an uniform cast of pig-iron cannot always be insured—any irregular working of the blast producing a corresponding effect upon the quality of the iron, which is, no doubt, further deteriorated by remaining beyond its due time on the hearth of the blast-furnace.

To overcome these difficulties and injurious influences, the patentees place two refineries between two puddling-furnaces, with which each communicates. One refinery takes its charge at a given time; and as soon as it arrives at the middle stage of the process, the second refinery takes its charge, and they continue so to alternate, providing a constant supply of hot metal to meet the demand of each puddling-furnace as the respective heats are drawn. By such method, a regular system of working is secured, and the difficulties pointed out as appertaining to the blast-furnace avoided. Instead of the hot metal remaining too long in the refinery, it is emptied at the proper time by the puddling-furnaces, whose united capacity is equal to the refineries. One especial object sought in combining the refinery with the puddling-furnaces is that of cheapening the production of the better class of iron—this plan giving an opportunity for selecting the pig-iron previous to its entering the refinery, which cannot exist when hot metal is taken from the blast-furnace. To a manufacturer of tin-plates, or a maker of iron who is not a smelter, but who aims at the production of a first-class metal, this plan will prove useful and beneficial. The advantage to be derived may be stated as including the production of a larger quantity of iron in a given period—two puddling-furnaces being made to do the work of four; consequently, the cost of wear and tear becomes reduced in a proportionate degree to the extent of one-half upon the quantity of iron made, a saving of fuel and wages in proportion, and a great reduction in the

necessary repairs to the back wall and jambs of the puddling-furnaces through the employment of hot refined iron. The patentees calculate that an actual saving of 10*s.* per ton may be effected in the production of the best puddled bars. Estimating the present price of fuel and high rate of wages, and in comparing the two systems, a marked feature exists in favor of the one under notice—there being a material difference between the properties of liquid pig-iron and liquid refined iron, the latter being purified to a much greater extent than the former, and thus yields the more readily to the action of the puddling-furnace, is sooner brought to a proper temper, and, consequently, the operation is more rapidly completed.

MOULDS FOR METAL CASTINGS.

Mr. Jobson, of Dudley, presented models in elucidation of an improved construction of moulds for metal castings, by which the process of moulding is rendered simple and easy, combined with economy. The moulds are of plaster of Paris, and other substances of a similar kind, and the advantages of the new plan are felt most in cases where a large number of castings have to be made from the same patterns; also where intricate forms of the patterns (as in foliage or ornamental castings) makes it difficult to draw from the sand in the ordinary process of moulding, and the irregular surface of the "parting," or separation between the moulds, increases the difficulty of making a clear casting. In this new process of moulding, after the patterns have been first partially embedded in the sand of the bottom box, and the parting surface accurately formed, the top box is placed on, and is filled with plaster of Paris, or similar material, to which the pattern itself adheres; when the plaster is set, the boxes are turned over, the sand taken out of the bottom box, and a similar process repeated with it.

GAS PUDDLING FURNACE AT ILSENBURG, IN THE HARTZ.

For several months past a gas puddling-furnace, on the principle of Thomas's, has been at work at this celebrated smelting works. The gas is produced from wood, turf, brown coal, but especially from the cones of the pine trees. The bar-iron produced by these furnaces is of the first quality, and can be produced at 36*s.* per ton cheaper than by the ordinary process. More recently still, a furnace has been erected at Mandelholz, near Rothehutte, in Hanover, fired by gases obtained from turf alone, and is proving very successful.—*Berg und Muttenm. Zeitung.*

QUARRIES AND CLAYS.

NATIONAL OIL-STONE COMPANY.

The National Oil-stone Company, Silas Smith, Agent, have on hand a large and superior lot of their far-famed oil-stones, ready to ship to New York City. Their stock is every day increasing. The demand for these valuable stones is so great, that this Company have now on hand more orders than they can fill for a year to come. They are also the owners of some extensive marble beds, or quarries, which they design opening and working largely by another season. —*Lake Superior Journal.*

CEMENT.

It is stated that a quarry of stone has been discovered in Mt. Tom, Easthampton, suitable for making water cement. A company has been formed,

and active preparations are being made for quarrying the stone and manufacturing the cement.

BRICK BURNING WITH CUMBERLAND COAL.

The use of coal for the burning of brick is not a new thing. It is, however, but little in practice, especially with bituminous coal, as yet. The following facts respecting the mode of using Cumberland coal for this purpose, are furnished to the *Cumberland Journal*, by an experienced brick-maker.

1st. *Description of kiln and mode of construction.*—The coal-kiln wall does not differ from those constructed for burning wood; the latter are usually from head to head thirty feet (or forty bricks) wide, but this is found too wide for using a poker for properly stirring the coal in the centre, and twenty-two feet (or thirty bricks) wide is found to work much better. The wood kilns are usually set with only three bricks between the fire beds, but it is found four can be burned equally as well with Cumberland coal, thereby adding about eleven hundred more bricks to each arch in the same depth of kiln, or about eight thousand bricks more in the same sized kiln. The kiln is constructed by building the piers upon which the raw bricks are set, four bricks wide, leaving a space between each pier of about one foot for air chambers and ash pits; these piers are built up about two feet above the ground, level with each other, upon the top of which the grates are laid, thus affording an air chamber immediately under each grate, running through from one side of the kiln to the other, two feet deep and one foot wide. Above the hole for the admission of air under the grates is another hole, through which the coal is thrown on the grates, thus making two holes for each arch on each side the kiln, as it is fed with air and fuel on both sides.

2d. *The manner of using Cumberland coal for burning brick.*—Doubtless much has yet to be learned on this point, which, when understood, will tend to further demonstrate the economy of coal for burning bricks. Caution has to be observed when a kiln is first fired up, so as to prevent the bottom bricks getting too hot; this can be prevented by leaving the upper door partly open, and by letting the fire run low before replenishing it; thus the heat from the bottom is conveyed more rapidly to the top of the kiln, being less obstructed by the coal on the grates. This caution has to be observed continually while burning, for all the heat arising from combustion necessarily passes through the first or bottom bricks, and as the draft passes up through the bed of coal on the grates, the more coal the greater the obstruction offered to the draft.

MISCELLANIES.

SAN FRANCISCO MINT.

A new Mint has at length been put in operation in San Francisco, calculated to coin thirty million dollars yearly. The following particulars describe the process for gold coinage. Silver will be coined there, but probably to a small amount:—

The first room in the regular order of the business of the Mint, is the Deposit Room. Here the metal is taken and weighed, and a receipt given. The scales are very large and nice, and cost in Boston about $1000. The gold is then taken to the

MELTING ROOM,

where each deposit is melted separately, in a blacklead crucible, and upon the melted mass saltpetre and soda are thrown and stirred about to oxidize the base metals, and the gold and more sterling metals, thoroughly mixed, are cast

into a bar. After being taken to the Weigh Room and weighed, it is ready for the

ASSAY DEPARTMENT.

The Assayer, with a chisel, chips off a corner from the bar, and the chip is melted and cast into a button, to give a round form, so that it may be easily rolled out. It is rolled into a ribbon and filed down till it weighs exactly ten grains, weighed by a scale which turns at the thousandth part of a grain. The ribbon is rolled up with sheet lead, placed in a little cup called a cupel, made of calcined bone-ashes, and placed in a heat sufficient to melt the gold, and the base metals, copper, tin, etc., are absorbed by the porous material of the cupel, or carried off in oxidation. The gold is then pure, except an admixture of silver, and perhaps a little iridium or platinum. The button is again rolled out into a ribbon about as thick as ordinary letter paper, and boiled in nitric acid, which dissolves the silver and leaves the gold pure, which is weighed, and the amount which it has lost gives an exact measure of the quantity of impurity in the original bar. Thus, if the piece assayed weighs nine grains, then nine-tenths of the bar is pure gold; and the clerk in the deposit room can immediately give a certificate of the amount of coin due the depositor.

GRANULATING MELTING ROOM.

After the bars have been assayed they are, as a general rule, thrown in together indiscriminately as the property of the Mint. The first process in the granulating melting room is to melt the gold with twice the weight of silver, and while melted it is poured into water mixed with a little nitric acid, and the metal falls to the bottom of the tub in fine grains. The granulated gold is taken out and cast into large stone or porcelain pots holding about fifteen gallons of nitric acid. These pots sit in hot water heated by steam, and the boiling acid soon leaves the gold pure from all silver, copper, lead, tin, zinc, or other base metals.

It is taken out, filtered, washed, dried, and again taken to the melting room, where it is melted with one-ninth its weight of copper, which makes it the standard alloy of nine hundred thousandths fine. No silver is used in the alloy. The gold thus alloyed is run into bars a foot long, an inch thick, and of the proper width for coin, from an inch and a half for double eagles down to half an inch for dollars. The bars are delivered over to the coiner.

DRAWING AND CUTTING ROOM.

The coiner's first process is to put the bars through the rolling-mill, which has two heavy rollers of cast-steel, ten inches long and eight inches in diameter, rolling together. The bars are thus rolled out a number of times until they are of nearly the proper thickness for the coin. The rolling-mill is made so that the bars can be made out of any thickness. The bars, when rolled out several times, become somewhat brittle, and are then taken to the

ANNEALING ROOM.

This room contains a large furnace of brick-work, with long chambers to receive the bars, which are placed in copper tubes and heated to a cherry-red. The gold is thus made softer and more ductile, and is again taken to the rolling-mill, rolled sufficiently, and again annealed previous to being drawn. The bars cannot be rolled out to an exactly equal thickness, and to secure exactness in this respect the bar is drawn through an orifice in a piece of steel, and this orifice being somewhat smaller than the bar as rolled, reduces the whole to the same exact width and thickness. The bar, not quite so thick as the coin, is taken thence to the cutting machine, which, by a punch, cuts out from the bar round pieces, a little longer than the intended coin. These pieces are called blanks. The blanks are carried to the annealing room, and washed with soap and water. They are then taken to the

ADJUSTING ROOM.

Here each blank is weighed separately, and made the exact weight for the coin. If too heavy, the blank is filed down; if too light, it is thrown into a box to be re-melted. The work in this room is done entirely by ladies.

COINING AND MILLING ROOM.

The adjusted blanks are run through the milling machine, which compresses the blank to the exact diameter of the coin and raises the edge. The purpose of making the edge thicker is to make the coin pile neatly, to protect the figures and to improve the general appearance. About 250 blanks are milled in a minute.

The milled blanks are carried back to the annealing room, placed in an air-tight cast-iron box and placed in the furnace to be annealed, so that they may take the impression well. When they are at a cherry-red they are taken out and poured immediately into water with a little sulphuric acid. This softens and cleans the gold. The blanks are taken out, washed with cold water, put into hot water again, taken out, mixed in with saw-dust, which is then sifted off and the blanks are dried and perfectly clean.

They are again taken to the coining and milling room and stamped. The coining machine is elegant and massive. The blanks are placed in a tube or pipe, and from this the machine takes them one by one, puts them between the dies, stamps them, throws them out of the die and carries them down into a box, and they are then delivered to the Treasurer and ready for circulation.

Such are the main features of the process. The treatment of silver is, of course, somewhat different. The difference between the United States coin and the California coin is, that the latter is alloyed with silver, the former with copper. The California gold contains a good deal of silver, and it is troublesome and expensive to separate it from the gold; besides, it is more difficult to make a copper than a silver alloy. The California coin being one-tenth silver, is worth more than the United States coin, and a premium is paid for it at the United States mints. There are about seventy-five cents worth of silver in a hundred dollars of California coin. The copper is a much better alloy, being harder, more durable, and more beautiful.

CALIFORNIA ACADEMY OF NATURAL SCIENCES.

May 22*d*, 1854.

Dr. H. Gibbons, vice-president, in the chair.

Mr. Nevins read a letter from Mr. Swan, designating a new and successful method of preventing the destructive ravages of the Teredo and of other aquatic borers. The paper was referred to Drs. Ayres and Trask, for investigation.

Dr. Kellogg presented a drawing of the California currant—*Ribes Viscosum.*

Dr. H. Gibbons, a specimen of *vicia annuum*, and called attention to its luxuriant growth; it attains a height of eight or ten feet, and bears a profusion of flowers and seed. The Indians use the latter as an article of food. He had some of them cooked for trial, and he thought they would be considered palatable in the absence of anything better. In a recent visit to Marin county, he had observed a species of Ribes trailing from ten to twenty feet among the bushes, growing plentifully; it bore thorns half an inch long; he had collected some of the currants, and had no doubt that cultivation would impart a valuable character to the fruit. He was surprised to see young apple and pear trees in full bloom and fruit at the same time; they would continue to bloom for two months or more, without affecting the fruit or spending the tree. He had seen trees in full bearing which had been transplanted this season.

Dr. Ayres made some remarks on some fishes of the Cyprinoid family.

In the true Cyprinoid fishes, the inferior pharyngeal bones constitute the only dentiferous apparatus, and we accordingly find that these bones are drawn, one against the other, by very strong muscles, in two pairs at least. Their separation, however, requires but slight force, and is effected by a single pair of very slender muscles, so slender, indeed, that close scrutiny is needed to detect them; the point of origin of these muscles exhibits a remarkable compensatory arrangement.

The region from which they should arise, to accomplish their purpose, was already occupied with muscles having different action. To obviate the difficulty, a pair of minute bones, not found in any other fishes, was added. These bones are not thicker, in a specimen weighing a pound, than a fine sewing needle, and only about an eighth of an inch long. They are suspended by very delicate ligaments to the interbranchial bones, and, of course, are easily moved. To enable them to serve as a support for muscular traction, a fine ligamentous slip passes from the apex of each to the interbranchial bone in advance of it. When the muscle contracts, this slip is tightened, and the bone, though so slender, affords a firm point of support. Could any evidence of design be more perfect?

These facts I demonstrated, some years since, upon the species found in the Atlantic States. Dissections of our California Cyprinoids display the same structure, and we may therefore infer that it is common to all the Leucisci and the allied genera.

In this connection Dr. A. proceeded to name and indicate five new species.

Leuciscus gibbosus, Ayres. Stouter and thicker than any previously described species of the genus. Mouth small. About sixty scales on the lateral line. Brown above, silvery below. Weight about a pound.

Leuciscus microlepidotus, Ayres. Form more slender than that of the preceding. Readily distinguished by its small scales, which number about a hundred and twenty on the lateral line. Length twelve inches.

Leuciscus macrolepidotus, Ayres. Form much like that of *L. Pulchellus*, though a little more slender; anal fin longer. Caudal much arcuated. Scales sixty, size of the preceding.

Leuciscus gracilus, Ayres. Body slender; head much elongated. Color silvery, becoming darker on the back. Scales about eighty. Much larger than any other known Leuciscus, weighing, it is said, thirty pounds or more, but generally varying as we find it in our markets, from five to twenty pounds. This is the species known here as the salmon trout, though a more incorrect name could scarcely have been selected, since the fish does not belong even to the family in which the trout are arranged. This is, however, but one instance among many of the misapplication of names to our quadrupeds, birds, fishes, etc.

Catostomus occidentalis, Ayres. Allied to *C. bostoniensis*, but distinguished by its shape, form of scales and of mouth. Weight one to two pounds.

All these species were obtained in the market, having been brought from Stockton. They are probably found in many of the upper waters.

Dr. W. P. Gibbons read a paper, describing two new species of viviparous fish, from the Bay of San Francisco. He first remarked that he had found it necessary, after examining numerous specimens of the species which he had described last week, to construct a new genus for the two which were then described as the *Cymatogaster aggregata* and *minimus;* as their characteristics would not admit them into that genus, he therefore proposed the name of

MICROMETRUS.—*Gibbons.*

Head of medium size, body ovate, compressed; snout protractile; lips thin; cheeks and opercula scaly; teeth conical, in a double row in each jaw, the inner row having from four to six; branchiostegal rays five; dorsal com-

mences behind the pectoral, and about opposite the ventrals; scales rather large; intestinal canal six to ten inches long; eyes of medium size; tail forked.

M. aggregata.—Gibbons.

M. minimus.—Gibbons.

He also proposed to construct a permanent variety in the genus Hysterocarpus, the *H. Oramensis;* though the differences observed from an inspection of about thirty specimens were very decided, yet they were not sufficiently so to warrant, at present, a second species.

MYTILOPHAGUS.—*Gibbons.*

Head of medium size; snout slightly protractile; lips thickened; cheeks and opercula covered with scales; with a soft membrane around the edges; body oblong, ovate, sub-compressed, arched; back somewhat flattened; teeth conical, a double row in each jaw, those of the lower jaw extending to the angle of the mouth; branchiostegal rays six; pectorals anterior to the dorsal; lateral line nearly concurrent with the back; scales large.

M. FASCIATUS.—*Gibbons.*

Curvature of the belly greater than that of the back; eyes rather large, about a quarter inch above the line of the upper lip; lower jaw a little the longer; dorsal with ten spinous rays, first short, the succeeding ones gradually increasing in length to the sixth, which is the longest, being about seven-eighths of an inch; articulated rays higher at their commencement than the spinous. Dorsal groove continuous to the end of the fin; pectorals long and pointed—first short and spinous; anal, first three short and spinous; the posterior half in a groove similar to the dorsal; scales smaller in front of the ventrals and along the base of the anal and caudal; space free of scales extending from base of the pectorals around the vaginal orifice about one-third of an inch wide. Head light ash-color or mottled with brown; belly silver-white; eight or ten diffused light brown transverse bands across the sides; dorsal with dark patches; dark bands across the tail and along the anal. Length, 15 inches; width, 6 inches; weight, 3 pounds.

D. 34, P. 24, V. 6, A. 30, C. 23.

HYPERPROSOPON ARCUATUS.—*Gibbons.*

Curvature of the dorsum greater, and of the belly less, than of the *Argenteus.* Mouth lower in reference to the eyes. Head shorter, eyes smaller, dorsal groove longer. About the same size of the other.

Reported by the Recording Secretary.

BOSTON SOCIETY OF NATURAL HISTORY.

Second May Meeting.

The President in the chair.

The President laid upon the table a number of copies of his recently published monograph upon fossil impressions, entitled "Remarks on Some Fossil Impressions in the Sandstone Rocks of Connecticut River." The principal part of these remarks were made at the meetings of the Society, and a portion of them have already been printed in the proceedings of the Society. Copies were presented to the gentlemen present.

Dr. Kneeland exhibited specimens of the bark, foliage, cones and seed of the Wellingtonia gigantea, the large coniferous tree recently cut down in California.

The bark was about seventeen inches thick, charred on the outside, and with no indication on the inside that the layers nearest the wood existed on the specimen: it resembles the bark of the Southern Cypress, though it is less fibrous and stringy: so that the bark must have been at least three feet, and probably much more of the diameter of this tree. This piece of bark con-

tained about twelve layers to the inch, marking an age of 216 years, if each layer represents exactly a year's increase; all the layers are of about the same average thickness. This calculation, supposing the tree to be 2000 years old, and the annual increase the same, would give the bark the thickness of nearly one half the diameter of the tree—whereas, in the Philadelphia specimen, at the height of twenty-five feet, the bark was about one-sixth of the diameter. Taking this ratio, which will probably be not far from the truth, as we shall see that the thickness of the annual layers of wood is also less in the youth of the tree, the diameter of the entire bark would be between five and six feet, supposing none to be lost by exfoliation. The probability is, however, that from constant exfoliation, the bark is no thicker now than it was 500 years ago. This foliage is cypress like, and is probably only one of the two forms common in trees of this family. It is well known that the deciduous cypress has two forms of leaves; the cones are oblong, and are said to have a thick woody axis—which cannot be fully verified, from the unwillingness of the owner of the specimens (Daniel T. Curtis, Esq.) to have them cut into. They will, however, be submitted to Professor Gray, and will doubtless serve to confirm or reject the genus *Wellingtonia*, which name has been given by Dr. Lindley.

The specimens were accompanied by a lithograph taken at San Francisco, of the tree from which these specimens were obtained. It is one of many gigantic trees found near the head of Stanislaus River, on the Sierra Nevada, California. Its height was 290 feet, its circumference 96 feet, and its diameter near the ground about 31 feet. The age was estimated at 3000 years, which, from the investigations of Professor Gray on a larger tree, is probably too great by at least 1000 years. The size and age of these trees is a matter of much interest; the one now on exhibition at Philadelphia was sound from the sap-wood to the centre, which is almost never the case in trees of other families—as the oaks, which often attain a great size. The diameter of the tree in Philadelphia, at 5 feet from the ground, was over 29 feet; at 18 feet, 14½ feet; at 25 feet, 12½ feet, the bark being 2½ feet thick; at 200 feet, about 5½ feet—its length being about 320 feet. The section, at 25 feet from the ground, (without the bark over 10 feet thick) has been hollowed out by fire and other means to a shell of about 4 inches in thickness. A piece of this wood Dr. Gray found to contain, on an average, 48 annual layers to an inch. The semi-diameter at this point being 5 feet 2 inches, (viz., at 25 feet from the ground,) supposing the tree increased in diameter at the same rate during its whole life, there would be nearly 3000 annual layers; but Dr. Gray, in consideration of the greater thickness of the layers of a young tree, and from comparison of sections of the so-called cypress of the Southern States, *Taxodium distichum*, (as given in detail in the Proceedings of the American Academy, Vol. 3. p. 96,) assigns about 2000 years as its highest probable age.

This tree is nearly allied to the *Redwood* of California, *Taxodium sempervirens*, Don, of late described under the new genus *Sequoia*, which is now growing in England, are rarely in this vicinity, where it is barely hardy. As we have new seeds of the Wellingtonia, it is hoped that ere long we shall have some young specimens of this gigantic conifer.

The President stated in this connection, that he believed the age of the great elm on the common in this city, to be much greater than it is generally considered to be. He can remember that, in his boyhood, this tree had all the appearances of decay, and was then apparently older than at present, and presenting an open and hollow trunk. Many of its large branches have been broken off by hurricanes, and in this way its life has been probably prolonged. Upon maps of the city, published between 1720 and 1730, it is put down as the "Great Tree," and it is said, that in the records of the Ancient and Honorable Artillery Company for the year 1686, is an account of a meeting of the company under this tree. When compared with the oldest trees on the malls of the Common, which were in existence there between 1720 and

1780, it will be seen that their antiquity is not to be compared with that of the Great Tree. The President thinks that it must be 800 years old and that it has sheltered not only our forefathers but the Aborigines before them.

Professor Wyman communicated the results of some recent researches upon the form of the heart and the physiology of the respiration in the Menobranchus. The group of reptiles known as Perennibranchiates, retain the gills throughout life associated with rudimentary lungs, and it has been a question what is the form of the heart in this group, i. e. whether they have a single or double auricle. It has been pretty well determined that the *proteus* has one auricle only: the *axolotls* of Mexico has been found likewise to have only one auricle. Professor Wyman has found the heart of the *menobranchus* to have a single auricle and ventricle.

It has long been well known that Batrachian reptiles respire partly by means of the skin, and this has been satisfactorily determined by the experiments of Edwards and others. Professor Wyman has seen in dissecting the vascular system of the frog after minute injection with coloring matter, that the branch of the pulmonary artery described by Muller as going only to the occiput, actually sends all of its blood to the skin, a fact to which attention has been recently called by Bernard. There are also branches from the vertebral artery, coming off with the spinal nerves and going to the skin. It is difficult to say at present what is the exact analogue of this branch of the pulmonary artery.

Professor Wm. B. Rogers communicated some observations recently made by him on the *Natural Coke* and the associated igneous and altered rocks of the Oolite coal region in the vicinity of Richmond, Virginia. In the district on the north side of the James River, where the most valuable seam of coke has been explored, it is at present wrought by two vertical shafts. In that nearest the outcrop the coke is reached at 112 feet from the surface, in the other at 207 feet, the dip of the coal measures being nearly west and at a low angle. A third shaft, recently wrought, which lies nearer the margin of the basin than either of the preceding, cuts the stratum of coke at the depth of 90 feet. A bed of whinstone, or coarse gray trap, is intercalated in the coal measures of this part of the basin, intersecting the two first-mentioned shafts, but cropping out a little west of the third. This bed is met with in the deepest and most western of the shafts at a distance of about 100 feet from the surface, and is more than thirty feet thick where it is cut through, but in the next shaft it is at a depth of less than thirty feet, and has thinned down to about half the preceding thickness.

One of the most remarkable effects produced by this igneous bed is seen in the stratum of carbonaceous fire clay which lies next beneath. This, which in the second shaft has a thickness of eleven feet, has been greatly indurated and made to assume a columnar structure, by which the whole mass is converted into a congeries of closely packed five and six sided prisms, often quite regular, usually about half an inch in diameter, and always at right angles to the lower surface of the trap.

A portion of this bed, originally occupied by impure coaly matter, presents the same columnar structure, but the material is a compact plumbaginous coke, with much earthy matter intermixed. The general aspect of the gray part of this bed strongly resembles that of the coarser varieties of fire-brick after they have been long exposed to intense heat. This is what might be expected, for in the bed in question we have the very material of fire-brick, and in the overlying trap we have a source of igneous action, which, in the originally molten condition of this substance, could not fail to work great changes in the contiguous strata. This columnar indurated clay, or natural fire-brick, when recently broken, emits a most offensive odor, partly that of sulphuretted hydrogen, and partly perhaps caused by a sulphuret of carbon.

At the depth of about seventy feet below the bottom of the Trap occurs

the bed of natural coke for the mining of which chiefly these openings have been made. This interval below the fire-clay is occupied by bluish and drab argillaceous and sandy slates, with some coarse sandstone, the former abounding in impressions of plants, among which may be noted Equisetum columnare, Zamites oblusifolius and Taeniopteris magnifolia, forms which many years ago Prof. Rogers pointed out as marking the oolite age of these coal-bearing strata. The baking action of the Trap is curiously shown in all these fossils. The coaly matter of the stems and fronds, when closely examined, is seen to be blebby or blistered. It is, in fact, coke, which, while it retains the outlines and stronger markings of the plant, has, in its partial fusion, obliterated all the finer characters of the organized surface.

The coke, where it has been successfully mined, forms a bed of about five feet thick, including but little slate, and presenting a nearly homogeneous mass of a bluish-black color, uniformly vesicular and light enough to float in water. It contains only a minute fraction of the volatile ingredients of the unaltered bituminous coal of this region, but it ignites readily and burns like the compacter kind of ordinary coke. Throughout the bed, but especially towards the top, it presents a partially columnar structure. Where this structure is marked, the coke is found to crepitate when heated. In some localities on the south side of the James River, where the whole mass of coal and adjoining shale has been rendered completely columnar, the material in the process of heating breaks up with explosion like the crack of a pistol, at the same time projecting its fragments to some distance from the grate.

The gradually diminishing influence of the Trap bed as we recede downwards is illustrated by the section in one of the shafts, which embraces a thickness of fifty feet of strata below the seam of coke above described. After passing through indurated fire clay, lying immediately beneath the coke, we have a thickness of about twenty feet of slates, followed by a thin seam of semi-coke, or coky coal, more bituminous below than at top; and after this, descending through some twenty feet more of slates and sandstones, we come upon a bed of bituminous coal, which appears to have sustained no alteration beyond the development throughout the mass of a columnar structure.' In the deepest of the three shafts, the seam, now wrought under the intelligent direction of Colonel Worth, corresponds to the coky coal above described, the lower layer retaining much of its original bitumen. In all these workings the gradation of metamorphic influence is beautifully marked within a distance of less than fifty feet of strata, from the greatly altered shale or fire clay immediately beneath the Trap, through the successive slates and coke seams to the unchanged bituminous coal at the bottom of the section.

Mr. Nathaniel H. Bishop presented the skull of a Peruvian mummy, in good state of preservation, represented to have belonged to a person of royal blood, and to have been found in one of the royal tombs; also some ears of corn found with the mummy.

Dr. Brewer exhibited the eggs presented by Dr. Bryant at the last meeting. The egg of the chuckwills widow (*Caprimulgus Carolinensis*) is of considerable value, being quite difficult to procure. The nest is placed upon the bare ground in the woods, and if the egg is handled, the bird always removes it. This has been witnessed by Audubon.

Dr. Kneeland presented some small articulates from Mantanzas; some frogs in different stages of growth; some gulf weed, etc.

Some specimens of *Paludina decisa*, from the Erie Canal, at Mohawk, New York, were received from Dr. James Lewis; also specimens of the reversed shell, and a few of the embryonic young, natural and reversed. In the Erie Canal, these shells, favored by peculiar circumstances, attain a very large growth, some of them being $1\frac{9}{16}$ inches long, by $\frac{11}{16}$ wide. They present, within certain limits, considerable diversity of form and structure. Dr. Lewis gives, in his accompanying note, some statistics as to the proportion of reversed specimens.

The President stated that he had received letters from Professor H. D. Rogers, and from Professor Baird, relative to a collection of specimens for the Society, which would be read at the next meeting.—*Boston Traveller.*

NEW PUBLICATIONS.

Cyclopedia of Chemistry, with its Applications to Mineralogy, Physiology, and the Arts. By Robert Dundas Thomson, Professor of Chemistry, St. Thomas's Hospital, London. 12mo, pp. 540. New York: D. Appleton & Co.

It has been the design of the author of this volume to prepare such a work as should serve as a useful reference to the science of chemistry. In this object he appears to have spared no pains or efforts. On the application of chemistry to the arts he appears to have enjoyed peculiar advantages, through opportunities afforded to him for many years by the manufacturers at Glasgow and Lancashire, of studying chemistry on an extensive scale.

In relation to the separation of metals from their ores, the work enters into extensive details, and illustrates the several metallurgical processes with numerous and accurate cuts. Each subject is treated in a condensed and extremely logical manner, at each step from the appearance of every variety of ore to the complete extraction of the metal. The practical workman, as well as the student, cannot fail to derive great assistance from this complete compendium.

In the preparation of the work the author has been aided by many of his pupils, who have by their attainments already reached prominent positions, and by many Reports presented to departments of the government, access to which was afforded him. We cannot but be pleased to see a work of such merit and usefulness introduced to the public here, and are confident of the satisfaction it will afford.

A Manual of Metallurgy; or, a Practical Treatise on the Chemistry of Metals. By John Arthur Philips, F. C. S. Second Edition. Revised, illustrated with numerous engravings. 12mo, pp. 620. New York: D. Appleton & Co.

This valuable work is probably better known in Europe than this country. For the information of those who are not acquainted with its contents, we would state that it has been the aim of the author to describe all the most important processes for the extraction of metals from their ores, commencing with the crude ores, and tracing them from the mines in which they are found, through the various mechanical and metallurgical operations which they undergo before the metal is obtained. These processes are illustrated with finely-executed cuts, suitable to render them easily understood and put in practice. In addition, there is much valuable and important information on the subject of assaying, which has been found already valuable.

This second edition contains some important additions to the first, such as the process for the purification of tin, and the European method of amalgamation. As a work for reference, or as a course for study, it is one of the most valuable of the kind which we have. Indeed, it is sufficient to say that the first edition attained the rank of a standard authority on Metallurgy.

THE

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EDITED AND CONDUCTED BY

WILLIAM J. TENNEY.

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ART. I.—MINERAL DISTRICT OF CENTRAL CALIFORNIA.*—BY PROFESSOR JOHN B. TRASK.

AFTER completing the examination of the coast mountains within the parallels alluded to, a visit was made to the mineral

* Under a joint resolution of the legislature of California, passed May 6th, 1853, authorizing a further examination of some parts of the Sierra Nevada and coast mountains, Professor Trask entered upon the survey, and prosecuted it until the 28th of November ensuing, comprising a period in the field of about six months. The first five weeks were occupied in examinations of the more elevated and western portions of the counties of Butte, Sierra, Yuba, Nevada, and Placer, in determining, as far as possible, the position of an ancient water-course in this section of the State, and its peculiarities—the description of which will be found in the body of this report.

On the 23d June the southern portion of the tour was commenced, and carried on almost uninterruptedly for four months. The route south was carried through the counties of San Francisco, Santa Clara, Santa Cruz, Monterey, and the north part of Luis Obispo; on the west, and returning on the east (or through that range denominated the *Monte Diablo* Range), by the west part of Tulare County, Mariposa, Tuolumne, Alameda, Contra Costa, and San Joaquin.

The range of country bounded on the north by the Straits Carquinez, and south by the Nacismiento, was divided into four sections, formed by lines running nearly east and west from the great valley to the coast. On the first of October, the country north of the Straits Carquinez was entered, and preliminary examinations only were made in the counties of Solano, Napa, and Sonoma. From the county of Napa a section was carried across the basin of the Sacramento, and connected with examinations made two years previous on its eastern edge. A similar section was also made, passing eighteen miles south of Monte Diablo, and continued across the San Joaquin.

The remainder of the months of October and November was employed in investigations of the middle mining sections of the county of Nevada, and those intermediate between the former and the middle and western parts of Calaveras county. The range leads through that section in which the principal gold mines of the middle portions of the State are located.

The report was presented to the legislature in the spring, and we are under obligations to the author in kindly forwarding copies to us. The portion we herewith publish, in relation to the mineral district in the central part of the State, is of immediate practical value. The entire report occupies ninety-five pages, and is the most valuable document which has yet appeared on the subject.

districts, embracing parts of the counties of Nevada, Placer, El Dorado, and Calaveras, the objects of which, was to connect a line of travel commenced in May and June last, in the counties of Butte, Yuba, and Sierra; and to obtain, if possible, some information respecting the general character of placer and quartz mining at the present time, compared with its earlier prospects.

Two years having elapsed since I had visited this section of the country, and having in my possession the original notes of travel and maps made at that time, with a general acquaintance of their former condition, it was deemed advisable to make this particular examination, in order to form some estimate on their future prospects.

With this view, the more central portions of the mining districts were selected, as these may be considered a fair example of the extremes, and from the lateness of the season and distance were more accessible.

PLACER MINING.

The extensive excavations, which have been made within the last two years, in this branch of mining, has afforded an opportunity of examining the different mountain formations not heretofore obtained, and has been the means of eliciting much valuable and interesting information relative to the early condition and mutations which have taken place in the superficial coverings of our hills. The rapid progress of advancement in the methods of conducting mining operations in this branch particularly, has opened a door for scientific research, which it seems impossible to have accomplished in so short a period as that in which they have been occupied; they have the appearance of having been in operation for half a century rather than the short space of *four years.*

It is now ascertained to a certainty that the placer ranges extend to the east, within ten or fifteen miles of the "summit ridge," so called, of the Sierra Nevada; and the condition in which it is found at these points is similar in all respects to that in the older or more western sections, with perhaps one exception, and that the relative age of both. There are evidences which clearly indicate a deposit of gold older than the diluvial drift of the lower or western diggings, (which latter is often confounded with the drift deposits of the tertiary periods in this country,) the character of which differs in almost every respect from any other deposit yet observed in this country, except in this particular range.*

* This deposit appears to hold a position and age below the tertiaries, and may be considered intermediate between the latter and the primitive formations in this State. Its fossils differ from any thus far found, in any formation within the State, and I am disposed to refer it to the Brandon group of Vermont, discovered by Prof. Hitchcock, vide Silliman's Journal of Science.

Its direction has been traced for about seventy miles, and is found to extend through the counties of Butte, the eastern part of Yuba, Sierra, Nevada, Placer, and El Dorado; it appears to have an average breadth of about four miles, with an elevation of four thousand feet above the sea for the greatest part of its length.

From the examinations that were made upon this range, there are abundant evidences that an ancient stream flowed through this section of the country, and in a direction parallel with its then existing mountain ridges, and the extensive mining operations conducted in the south-east part of Sierra county on this range, has been the means of demonstrating this fact, which had heretofore been strongly suspected only. The outliers of its banks are very definitely marked throughout the entire length of the formation under consideration, and its former bed filled in many places with a volcanic sand and ashes, which probably accompanied its displacement.

In the county of Sierra these peculiarities are best observed: in the vicinity, and for ten miles west of Downieville, the hills are covered with a volcanic brecia and tufa, which may be conveniently studied between the Negro Tent and Galloway's Ranch, also on all the hills and ravines surrounding Yumana on Oregon Creek. On the creek the tufaceous deposit is found to the depth of sixty feet.

The exact point from which these immense quantities of volcanic material were ejected, is somewhat obscure; yet there are reasons for the supposition that they had their origin in the truncated cones which lie a few miles to the north-east, and of which the Pilot Peak forms one of the principal points or centres of this rugged and forbidding district. This presumption is based on the grounds that between Pilot Peak and Yumana there are ample evidences of a direct connection with these larger centres of disturbance; an extensive dike of black scoriaceous and vesicular lava is traceable throughout the entire distance between Yumana and the Pilot Peak, passing through the hill north-west of Downieville, and within two hundred yards of the town, it crosses the river at this point, and appears at Durgan's Flat on the opposite side of the stream; from thence it is again met near Galloway's Ranch, and continues from there to the high bluff which overhangs the town of Yumana, on Oregon Creek. There are no other true volcanic cones in this section that would seem commensurate with so large a scale of operations, except those above noted, though the minor peaks undoubtedly added much to the general result.

The displacement of this ancient stream and the subsequent filling of its bed has opened a new and rich field for scientific research in this State, but its more direct and economical bearings are that it affords an equally new and extensive field for

the operations of the placer miner, and that thus far it has proved itself equal to that of any range yet discovered in this country. Besides being equally abundant in its produce of gold as far as opened, with the best placers of the State, it possesses the advantage of being the most extensive of any one system which has yet been found. The peculiarities which characterize this formation, and which distinguishes it from all others in the State, are the following:—the boulders found throughout its entire extent are very uniform in their characters, and are composed of quartz exclusively (or nearly so); this has a bluish-watery color in the mass, highly translucent and vitreous when fractured, constituting ninety-seven per cent. of all the stones found in the deeper diggings; they are invested by a dull but deep blue earthy material highly charged with pyrites, which in most cases is as firm as the rocks themselves, making it extremely laborious and difficult in driving shafts or adits. The gold is contained in this matrix for a distance of six or eight feet above the "bed-rock," and resting directly on the latter; it is coarse and generally rough, and its external appearance is that of a poor quality, though it assays high and brings the first prices; its pale and dirty appearance is due to a small quantity of arsenical pyrites which adheres to its surface, and which is found in considerable quantities in the matrix containing the gold.

The underlying rocks are serpentine and talcose slates; on Oregon Creek they are found to contain small veins of mundic (arsenical pyrites), one or two inches in thickness; this has a clear and lively grayish-white color when recently fractured, but soon tarnishes on exposure, becoming a dirty lead gray, and even quite dark: this mineral is rich in gold; it is difficult to find a small piece that does not present this metal to the naked eye on some part of its surface.

The mineral was first observed in the Johnson Shaft, half a mile north of the town of Yumana, and occurs at a depth of fifty feet below the level of the creek, at the edge of which the shaft was driven; the strike of these veins was north-west by west, and is found on both sides of the stream on that line. There were four other shafts in this vicinity in which the mundic was found under the same circumstances; and there can be scarcely a question but that it exists in true veins among the serpentine rocks throughout this part of the country. These veins have been found to penetrate the rocks in which they occur to the depth of six feet from the surface, and should it ultimately be found that the area is in any way considerable through which they run, they offer sufficient inducement to erect works for the reduction of this ore.

The blue color of the drift in this range has been found to pervade all parts of this peculiar deposit wherever it occurs; its boulders maintain their character and per centage; its extent

over so large a district, its dissimilarity in these respects with all other placers yet known, has suggested the propriety of adopting a name which shall at once separate it from other sections, in order to designate more particularly its course and extent in the future; by this means we shall in a short time be able to acquire additional information relative to its extent that we do not now possess; and as its developments at the present time are of so flattering a nature, that any information of its present undiscovered boundaries would add but another link to the great chain of our mineral resources equally as important and productive as the best now known.

I would, therefore, suggest that the term "*Eastern Blue Range*" be applied to this district; this will separate it from those lower down having the same color, but not possessing any one of its other peculiarities.

To define more particularly the position of this formation, both geographically and geologically, we will follow more particularly the outline of the ancient stream, and some few of the localities now situated upon it. On the south fork of Feather River, opposite to Sailor Bar, and east of this locality for three miles, it is found in the form of small flats on the sides of hills declining to the east; passing to the south, it is met with a short distance from Goodyear's Bar; again at Yumana, on Oregon Creek; still farther south at Minnesota, at Chipseg's, Smith's, and Kanaka Flats; crossing the middle Yuba, it is found at Orleans Flat, Moore's Flat, New Flats; thence across the south Yuba, by the towns of Eureka, Washington, and Poor Man's Creek, and at Mule Springs. This vicinity has presented an area of nine miles in which this formation has been found. Crossing Bear River, it is again met at each side of the American Forks, and is particularly well developed in the vicinity of Sarahsville, extending from thence to Georgetown. South of this but very little is known of its location.

Within the extremes of north and south named above, the banks of an ancient stream are distinctly marked out, and can be as easily traced as if the waters were still flowing in their original bed. It must have existed at a date when the adjacent country maintained a much less elevation than that now existing; this is proven from the fact that even at this time a terraced form is observable in many places, in each of which the same peculiarities abound. The organic matters deposited are perfect in their forms; the most delicate parts of leaves are truthfully preserved to nature; the material in which they are imbedded is that usually found suspended in waters that were but slightly disturbed, and when disintegrated yields an almost impalpable powder—not a pebble, nor even coarse sand, is to be found in any part of it. In fact every feature that would indicate a quiet state of waters is fulfilled in the section under consideration.

Had it been otherwise, the leaves and other tender parts of plants would have exhibited a different appearance from that they now present.

The remains of plants found in these localities are extinct on this part of the coast at the present date; the fruit, leaf, and structure of the sap-vessels, differ from those of every other section of the country, either fossil or living. I have been enabled to obtain six varieties of leaves, and two varieties of fruits, which will be described as soon as opportunity shall offer. The depth at which these specimens were obtained from the surface was one hundred seventy feet, and near the end of an adit whose length was five hundred eighty feet. The principal bed was found in the Arcana Tunnel, at the town of Minnesota.

The position of this formation has been stated in the preceding pages, to be below the tertiary groups and diluvial drift of the other placers. It will be unnecessary to roam over the entire State to illustrate or prove this point, as we have an adjacent district where both may be studied with ease and facility in an hour's ride between them. This locality is found at Chipseg's and Smith's Flats, about midway between Minnesota and Oregon Creek. The different formations will be given as they occur at Smith's Flat and Minnesota, which will fully illustrate the existing differences.

At Minnesota we find the following in the descending order: first, volcanic tufa; second, diluvial drift, containing no gold and having a depth of seventy feet; below this is found a bed of clay and imperfectly formed slates, beneath which is a boulder formation of thirty-eight feet, composed almost exclusively of quartz; succeeding this is the formation in question, containing the silicified woods, and leaves and fruits, the latter in the form of lignites, and in abundance. Following a direct line from this locality to Smith's Flat, and at the distance of half a mile from the latter, we meet an outcrop of the slates. Above these slates the drift and gold of this latter locality is found, and contains petrifactions of present existing species of plants and trees, which still flourish in the adjoining neighborhood; among these the pine and oak are very prominent. The structure of these silicified woods are as perfectly delineated as in the trees of similar character growing above them. The drift deposit at this locality is composed of every variety of rock found in the adjoining countries, being composed of trap, granite, porphyries and quartz, forming no well defined order of position.

The drift deposit of Minnesota being almost exclusively of quartz, such as has been described as occurring at Yumana, forms a wide contrast with the above, and beneath the boulder formation the lignites, consisting of six species, none of which are identical with any living species, or with the deposits of the section north of this locality. It will be seen from the peculiari-

ties thus briefly enumerated in relation to the main features of both deposits, the widely dissimilar character of the minerals composing both, their relative position, and the difference in the organic deposits found in both, there is sufficient reason for assigning to each a different age.

How correct this conclusion may be, it yet remains to be proved, if additional testimony is required; and this can only be known when this particular section shall have been more fully explored. Certain it is, however, that its present appearance favors this classification; and should it prove as productive in its auriferous deposits as the partial explorations upon it now indicate, the amount of gold which it is capable of producing would be unequalled in any district heretofore or at present known. There is not an instance known, where the lead in this range has been found, but that large sums of gold have been the result; this might be saying more, perhaps, than prudence would dictate, but such are the facts in the case, let opinions be what they may.

QUARTZ MINING.

For two years past this branch of industry has engrossed much of public attention, and speculation on the future success and prospects of these mines has been as diversified and fluctuating as upon any subject ever presented to public consideration; this has resulted from an incorrect appreciation of their intrinsic value, and want of information respecting their position, geologically considered, coupled with disappointments resulting in too high anticipations of abundant products from these sources in too short periods of time; the hasty and inconsiderate manner in which persons entered into these speculations in the country heretofore, and the natural results which must necessarily flow from such a course of action, has had the effect to cast a shadow of doubt, for the time being, on the future prospects of these sources of wealth, while the pecuniary losses that followed in the train of these causes were construed by alarmists abroad as indexes of certain failure, and thus rendered the doubt that existed an *apparent* certainty.

All this, however, has had a beneficial effect in its ultimate results, by checking that abnormal cause of action incident to the first outbreak of all speculative movements of this kind. Had that cool discretion and judgment which has marked the subsequent career of these undertakings—that firm determination to surmount all natural obstacles and test the truth or falsity of the claim advanced of the value of these veins, been practised in the earlier stages of quartz mining, we should have been spared the disagreeable task of chronicling adversity and *pseudo failures* in a legitimate and profitable branch of employment, thus saving this one of the grand levers of our commercial pros-

perity the odium that has heretofore attached to it and is still persistent in the minds of some abroad.

Aided by the discrepant and in many cases malicious reports from our own hills, the *savans* of the Atlantic States and Europe reiterated the howl, and the public of those distant shores were nightly harangued in the lecture-room, and popular assemblies, on the utter *impossibility of the auriferous veins of this country proving to be more than a mere ephemeral show*, and unworthy the confidence of reflecting minds. Their gratuitous expressions and unfavorable opinions are now proved, from the subsequent explorations which have been conducted on these veins, to be equally unfounded as were the arguments made use of by these men to convince their listening audiences of the *supposed facts* they so learnedly put forth; and our citizens engaged in these pursuits of industry have labored on, temporarily affected only by the confusion of opinions and anathemas issued from the portals of science, against this great interest of the State, and have borne the testimony triumphantly to the world that science unattended by personal experience will render him who uses it far more notorious than popular or reliable.

Notwithstanding the disadvantages of a manufactured public opinion with which this branch of industry has been obliged to contend, and the serious obstacles which have thus been presented to its progress, it has now become one of the permanent employments of the State, and should it meet with no other impediments than those which are the resultants of nature, it will obtain a position second to none, within the next two years.

The permanency of their character would scarcely have been demonstrated in the short period of time in which it has occurred, in any other country or State except this, and is in true keeping with the firmness of purpose manifested in every great undertaking by the citizens of this State, and is but another mark of that indomitable perseverance in overcoming difficulties either natural or artificial, that stand in the path of their advancement, for which they have become peculiarly characterized and proverbial.

The popular belief that the gold mines of this State, and the operations conducted upon them heretofore, have been suspended, with the exception perhaps of a few isolated cases scattered through the country, and that they hold but a forced existence for speculative purposes, designed ultimately to be the means of conducting swindling operations on a large scale abroad, is as base as it is unfounded; those feelings and ideas find a haven in the breasts of a few only, who from their position commercially have been the means of propagating this erroneous and unjust opinion in relation to this subject. The embittered feelings of such persons, which have had their origin in disappointed hopes arising from too hasty conclusions respecting the productiveness

of those operations in which they were individually interested, and which in nearly every case was caused by inadequacy of means and mismanagement of their operations, is no criterion whereby to form an opinion that would be just or reasonable, with reference to these metallic veins, and those in this country who would still propagate those opinions, do so in the face of every evidence to the contrary which reason or sober judgment would demand or can be found in this or any other country.

With these preliminary remarks on the general impressions at home and abroad, respecting their *theoretic* value, founded as they are on presumption rather than evidence, we shall proceed to consider the geological position which the quartz veins of this State hold to the rocks with which they are found in connection, hoping thereby to elucidate more clearly their present as well as prospective value.

QUARTZ VEINS AND THEIR RELATIVE AGES IN CALIFORNIA.

The quartz veins of this State are found distributed in nearly parallel lines throughout the west flank of the Sierra Nevada, and consist of three distinct lines separated by intervals ranging from four to eleven miles; as these divisions are found in nature they constitute what may be denominated the principal or main ranges. Between these are to be found smaller lines of these rocks at times running parallel with the former, at others having strikes more or less oblique, and even at right angles in some instances with the principal veins.

From the peculiar distribution of these rocks, as relates to their connection and position with the formations in which they are found, it would be difficult to refer them all to the same age; this would be manifest only by observing the different sections in which they occur. They will therefore be designated in this report as the *Older* and *Recent* groups, in order to better describe the peculiarities that may be found in both, and with reference also to the age of the rocks which they have been the apparent cause of disturbing.

OLDER GROUP.

The eastern and also a part of what may be termed the central line of dikes are included under this head. This group is found to have intruded itself through the primitive formations only, or through the trapean rocks which immediately succeed the primitive. The principal rocks which appear to have suffered the greatest amount of local disturbance and dislocation from these quartz veins, have been the granite serpentine and the earlier trapean rocks, which appear to underlie both the former. The veins or dikes that occur in the primitive series are usually much more massive than those of a later period, and are not

distributed over so wide an area, or possess so great a number of lateral veins, or cross-courses incident to the more recent group of these rocks.

The mineral characteristics of the Older Group are more uniform and regular so far as known, and are found to possess a firmness of texture, where they enter the greenstone, much greater than those of recent date. It is seldom found that this suite of veins has cut through or in any way disturbed the slates which rest on the granite, even when the latter are in the immediate neighborhood; less rare is it to find them cut through by the older group, that in a line of travel over two hundred miles in length, I have seen but two instances in the eastern range of veins, and it is even questionable whether this dike belonged strictly to the older group.

The effect of these veins on the rocks which they pass through, has been to disorganize their structure to a considerable extent, which has rendered the decomposition of both more rapid and complete, hence it frequently happens that rich deposits of metal are found in such places, and usually occur near the point of contact of both series of rocks. The older group is found to extend from near the summit ridge of the mountains to a distance of about forty miles toward the west, and constitute nearly six-eighths (6-8) of all the veins found within this line of distance, and on these are located the greatest proportion of all the mines at present in operation.

In that portion of the country lying north of the Cosumnes River and ranging thirty miles east of the Valley Sacramento, the central line of dikes belonging to the older group are found; their western edge passes through the counties of El Dorado, Placer, Nevada, Butte, and Shasta, and as far north as the Mt. Shasta hills to the east of the peak. It is well developed in the counties of El Dorado, Placer, and Nevada, and in one locality in the county of Yuba, a short distance above Scott's Ferry. In these latter counties the more recent group is also found, and in the county of Nevada it is seen to have disturbed the older groups in some localities, and in Placer county, where both have features in common, which will be noticed more particularly when treating of the Recent Group.

To localize the upper and older group of these veins, a few localities will be given for the purpose of familiarizing their geographical positions; in Nevada county it is met with at the National vein, also at German Bar, at the Ariel Mine in Sierra county, and the Jamison Creek Mines in Butte county; on the American Forks at the Volcano Mine, El Dorado county; Leake Vein, Calaveras county; Big Oak Flat, and Marble Springs, Tuolumne county.

These localities are situated far into the mountains, and are situated on the eastern part of this line of dikes, and upon those

parts of it where it is most largely developed, becoming an extended and well defined continuous range.

Returning to the middle or central range of dikes, at the distance of thirty miles from the valley, and travelling south we find that immediately after crossing the Consumnes, the granitic rocks that have heretofore been found associated with this range of veins further north begin to disappear in a gradual manner, and the prevailing rocks are talcose, to the exclusion of almost every other of the primitive series; for a distance of about fifty miles, the quartz is found associated with this or some of its subordinate members, the granite rocks lying far to the east. The quartz vein found among the talcose series and which appear of the same age as those occurring in the granite, are equally uniform in the general characteristics they present, so far as relates to their mineral constituents, but there is one remarkable feature attending them here (as also to the north in a few instances,) which is not common to the granitic associations of these rocks, viz: the depth to which the vein is decomposed from the surface down, will not exceed more than one-fourth that which will be found where the inverting rock is of the granitic series. This peculiar feature is very striking in passing from a "sett" situated in the latter to one located in the former, and will be found to hold good even in the same neighborhood.

One other feature is equally apparent, and at the same time important in connection with this, which is, that while those veins present the contrast above noted, the "setts" occurring in the serpentive series which have been unaffected by the cause producing such extensive decomposition as is found among the granite rocks, do not possess a texture so firm and coherent as the veins found in the northern sections, such veins will be worked with a less amount of labor and capital producing an equal amount of ore.

There is nothing to distinguish the veins of this section from being of the same age with those at the north, and running through a similar range of country, like the veins of the granitic series they do not appear to have disturbed the more recent formation of the tertiaries, but are confined exclusively to the primitive rocks. Following a line west toward the valleys, the occurrence of a more recent group becomes manifest, and is unquestionably the equivalent of that alluded to as occurring throughout the northern counties.

RECENT GROUP.

This group of these rocks is found extending from the lowest foot-hills on the east border of the valley, where the first outcrop of the slates are met, to a distance of about eighteen miles to the east, and after is found running into the western edge of the older group; their intrusion appears to have formed one of the

principal and later disturbing agents that has been in action in those periods of developement of that part of this country, immediately preceding, and continuing into the middle Eocene and Miocene periods of the Tertiary era.

Their altitude above the sea is variable, from one hundred to fifteen hundred feet, and some few localities reach the height of two thousand. One of the features, which this group presents, and which distinguishes it from those of the older group is, that they have cut through and disturbed not only the primitive formations, but every other formation found resting upon them; this occurs in almost every case in which these rocks are found. A dike of this age is often found protruding through the granite or some other member of the primitive series, and may be traced frequently for one or two miles before any member of the sedimentary rocks are met with; in this case, the latter rocks will be found more or less disturbed at the point of contact with the vein, and it will often be found that its passage from the granite beneath into the slates above is perfect, traversing the overlying rock through a great part of its length, and sending out cross courses in every direction. A disturbed position is not the only change observable in these cases; structural change is as often the result of the intrusion among the slates as the appearance of the veins themselves. The above peculiarities in relation to these veins are observable in every part of the lower mining districts, and an erroneous opinion in regard to the age of the dike under examination may easily occur as the part under our observation may be situated either in the primitive or sedimentary rocks.

A dike of this character occurs in the town of Centreville, Placer county, and extends in a northerly direction for one and a half miles through granite, when it enters the slates, passing entirely through their length and again appearing in granite at their northern extremity; another instance of a similar character is met with on Deer Creek, two miles below Nevada; here the dike passes through the trap, granite, and slate, and also at Newtown in the same county. Still further north, in the county of Yuba, a vein cuts both the granite and slate, as in the vicinity of Brown's Valley, and again on Dry Creek; in many other localities throughout this range of country, the same features are to be found, and our opinion on the comparative ages of these veins can be correctly founded only by a careful examination of the entire length of the vein.

On the same range of hills, this group is continued south as far as the Tuolumne River, and includes the district on which some of the principal companies of the southern counties are located. It frequently happens that the veins of this group are composed of a perfect *net-work* of small threads and veins, varying in power from one inch to one foot. This peculiarity is

admirably exemplified at Angel's Camp in Calaveras county; at this locality and for miles around these small "*hilos*," constitute a large part of the rich veins of this section, while at the distance of four miles to the south, it again appears as a mammoth dike, popularly known as the "Great Carson Hill Vein," which extends southerly to the Stanislaus River.

From this point a line of large dikes, interrupted at intervals, continue in a south-east direction for sixty miles, passing through Campo Seco, Coultreville, Bear Valley, and thence to Mt. Ophir; throughout this entire distance they are found to cut through all other volcanic rocks, with perhaps one or two exceptions; the basaltic rocks in some parts of the southern counties, bear evidence of displacement by these intrusions, and I know of but two cases in which the latter intrusions have *thrown* these veins, and in these cases it is not yet fully determined whether this be the fact. It is on the west flanks of the hills in which the dikes of the recent group of quartz appears, that the features which mark their age are more particularly noticeable; here the slates (and in the foothills, the sandstone) present all the varied changes of position and structure, noticed by different writers on the physical features incident to the mountain districts of California —at one time dipping east, at another west, and again half inverted, in the multifarious disturbances to which they have been subjected.

The greatest amount of displacement in the sedimentary rocks is always found in the closest proximity to the veins in their immediate vicinity, and although a vertical position only may be given in many instances, yet this is found to become less as you recede from the vein on either hand transversely to its line of strike; it is not unfrequent that the high angle of dip in the first instance will assume a nearly horizontal position in the distance of a mile from the point of uplift, but the next ridge will present a re-enactment of the first case, if the rocks composing it are of the same character.

The vertical position of the slates, is one of those peculiar features which attracts the attention of almost every person passing to or from the interior, from their appearance resembling an old church-yard, they have been termed the *grave-stone slates*, and this distinctive feature is found to prevail to the lower range of foot-hills toward the valley, as well as in the more elevated parts of the mountains; this verticality among the lower hills has been urged as an objection to the point that the intrusion of the quartz of either group was not the immediate cause of that uplift, but that the present inclination has been given by causes of a similar character which have acted subsequent to the intrusion of the quartzose veins.

This proposition seems invalid for this reason: if any such agency as that proposed had been the immediate cause of pro-

ducing the effects which are observable among the slates of this section, and sufficiently powerful to have forced them into the position they now occupy, it seems but reasonable to suppose that some portions of the intrusive materials should make their appearance among them; but this is not the case, nor is it necessary to introduce such a complication in order to explain the physical features which are apparent in these rocks, as we find an agent distributed largely among them, which is fully adequate to induce all the changes of position or structure noticeable.

That we do not find massive outcrops of these dikes among the slates at the edge of the valley, is equally invalid as an objection against their agency in producing the disturbances which are clearly attributable to their intrusion a few miles farther to the east, for an examination will convince the unprejudiced mind that the causes which have been instrumental in tilting the slates from their former position in the interior, has extended to the eastern edge of valleys and produced the ruptures we there witness.

In favorable situations for observing the intrusive character of the recent group, as in the canons through which flow many of our streams, it is there found that the porphyries which lie superior to the primitive rocks, and have had their origin from contact with igneous rocks in an incanderescent state, as well also as the trapean rocks adjoining, are broken through the sedimentary rocks above them, which are still unchanged.

Another fact of interest, and having an important bearing on this part of our subject, is found on the west borders of the great valleys and in the coast mountains. From all the testimony in our possession at the present time relative to the sedimentary rocks which dip under the valleys of the Sacramento and San Joaquin, we are induced to believe that those which occur on the east border are of an age cotemporaneous with those on the west, and in addition thereto, a group is found which evidently belong to a still later period. We have in these mountains, then, a corroborative evidence that the disturbances produced by the intrusion of igneous rocks with which the quartz is found in connection has occurred during a comparatively recent period.

As these rocks have forced their way to the surface through all the species that lie above them, they can be considered in no other light than having an age posterior to most of the tertiary rocks within the State, or the northern and middle parts of it; and cotemporaneous at least with the lower portion of the miocene period. Under these circumstances it is not to be wondered at that gold may be found in San Francisco or Contra Costa, as the geological formations which have developed it east of the great rivers, are found also in the mountains to the west, though not to the same extent.

The disturbance of the recent sedimentary rocks of the coast

mountains, and the character of some of the intruded masses that has produced the tilting and dislocations, their identity with the stratified rocks on the eastern border of the great valleys, leads us to the conclusion that the causes of uplift which have been found among the latter were continued partially to the coast in the same period. With respect to the agents that played an important part in these turbulent periods, there can be but little trouble in their discrimination, and ample testimony is found to identify them with the recent group of igneous rocks under consideration, and if these conclusions are correct, the character for permanency of these veins is beyond all cavil or doubt.

Future investigation may disprove this position, but until it is made evident that the veins of the recent group have been disturbed by other and more recent volcanic agents on either side of the great rivers, we can regard them in no other view than being among the last of an extensive series of disturbances, which have operated principally through a large portion of the Sierra Nevada, at a comparatively recent period in the geological history of this part of the continent.

The metalliferous character of this group is in no way inferior to that of the older ranges of these rocks; the proof of this rests in the fact that some of the best placers yet found in this country are included within its boundaries, among the alluvium and drift deposits of the tertiary epoch. The gold generally found in these placers, is of that character known among the miners as "rough or recent gold," having suffered but little from attrition by water; but it is not unfrequent to find the recent metal associated with that which has been much worn by attrition, and the two qualities thus appearing in the same placer range, can be regarded only as having different origins and ages. It would scarcely appear reasonable to suppose that two pieces of metal, driven from the same source, and subjected to the same action, should present smooth and rounded surface in the one; while its fellow beside it, shall retain all its angularities as though just detached from its original matrix.

With reference to the older group of these veins, there are features manifest which are both interesting and important, when we consider the immediate position of the recent group, to those of the older, where both are found in contact. It has been remarked in the preceding pages, that the veins of the older series have disturbed the greenstone below, and the granite above only; a casual examination of the district in which these veins occur, would convey to the observer an idea that a discrepancy in the statements must exist, from the fact that veins which pierce the granite, are found to cut the stites also in the same section. As in the case of the Centreville veins, these will be found to belong to the more recent intrusions of these rocks, and wherever those features occur, the recent group will be

found playing the part of a disturbing agent, on the primitive veins themselves, and their investing rocks; so far as our experience goes in judging of the effects produced by these recent intrusions, their influence is not an injurious one, for the recent dike has thus far proved equally metalliferous with the primitive setts.

[To be continued.]

ART. II.—THE EMPLOYMENT OF STEAM IN CERTAIN METALLURGICAL OPERATIONS.*—By M. E. CUMENGE, ENGINEER OF MINES.

CHEMISTRY and Metallurgy have common principles, although they differ in their means of action. Metallurgy is more an art than a science, and can only serve itself by re-agents, which, few in number, fulfill the necessary conditions of abundance and cheapness.

The workman intervenes by his labor in metallurgical operations; he modifies chemical reactions, he brings into action those that could not be produced without his assistance in such a manner, that with very few re-agents metallurgy can now produce the most varied effects. Science has applied itself to investigate metallurgical phenomena, but ought it to limit its part to that? Cannot chemistry pretend to any innovation in an art which rests on the same principle with itself. Until the present time, it is true, the little success met with by chemical innovations in metallurgy affords small encouragment; nevertheless, if the conditions necessary by any method, to insure success on the large scale are not lost sight of, I believe it possible to open by science new processes in the working of metals. The agents employed for the reduction of metals, are confined to a very small number of bodies, that are produced in abundance by nature. Atmospheric air, combustibles, gas from their combustion, and some fluxes, serve alone to produce, with the assistance of workmen and proper apparatus, the numerous phenomena of oxidation and reduction, which are necessary before drawing the pure metals from the complex combinations in which they are offered to us by nature.

The end I propose, is to show how there can be added to the list of metallurgical re-agents, a substance easy to produce, and at little expense—the vapor of water; and how to simplify, or perfect, by its employment, the processes at present in use. I will take for example the metallurgy of copper. Every one knows the method followed in France: our learned professor,

* Translated from the Annales des Mines, for the Mining Magazine.

M. Levol, has rendered familiar by his fine treatise, to all those interested in metallurgy, the complex re-actions that take place in the series of operations of the Galloi's treatment; he has analyzed the causes of complication in this method, and shown how the presence of antimony and arsenic render necessary the numerous series of roastings; the difficulty becomes very considerable when the proportion of antimony and arsenic augments a little; and when the amount of these hurtful substances rises to 30 per cent., as in the case of the gray copper of Monzaja, one is obliged to make them pass in small quantities in the general working of a large establishment. Pre-occupied with these difficulties, but at the same time penetrated with the advantages that could be drawn from the manner of treatment at Monzaja, in an establishment on the shore of the Mediterranean, I have sought to ascertain what would be the effect, on the ores, of the vapor of water at a certain temperature.

While experimenting, I at the same time had a knowledge of the experiments of M. Regnault, inserted in the *Annales de Physique et de Chimie*, in 1836, and which treat of the action of steam on metallic sulphurets. I have, nevertheless, persisted in making known the results to which I have arrived, hoping that perhaps these experiments undertaken, not in a scientific point of view, but with the end to application in practice, may be of some utility now that the question of driving off completely the arsenic and antimony, is the order of the day, and the insufficiency of the present methods are generally recognized. The ore of Monzaja, which has served for my experiments, has the following composition:—

Copper,	0,18
Iron,	0,04
Antimony and arsenic,	0,28
Sulphur,	0,08
Carbonate of iron,	0,37
Sulphurate of baryta,	0,03
	0,98

After having crushed it, I introduced it into a tube of refractory clay, which was itself placed in a reverberatory furnace: at the two extremities of the tube were fitted, by means of corks, two glass tubes; one of them served for the admission of steam, and the other for the disengagement of the products of the roasting.

In heating the tube with precaution, and as much as possible in its superior part, in order to avoid the agglomeration of pulverulent matter, there soon appeared in the tube of abduction, a peculiar product, drawn along by the steam, and which condensed with it; it had a reddish yellow color, and contained sulphur, arsenic, and antimony. To account for its production, it is

necessary to consider the action that water exercises by each of its elements, on the different substances constituting the ore. It was easy to assert the presence of sulphuretted hydrogen, which acts on the products of the oxidation of the antimony and arsenic in the nascent state, and forms by the favor of an excess of steam the volatile reddish compound of which I have spoken. For the rest, the temperature modifies the products; they vary also with the different lengths of time they are submitted to the operation: sometimes mixtures of the vapors of antimony, and arsenic, and hydrogen, often sulphuric acid, are disengaged; but a constant fact is the production of a volatile reddish substance. The production of this body, so easily passing off by the tube, gave me hopes to succeed in driving off entirely the antimony and arsenic. What hinders this result in roasting by the ordinary process, in the atmospheric air, is the transformation into oxides not completely volatile, of the production of salts of antimonious and arsenious acids, and the reproduction of sulphurets; but with steam, and the low temperature which suffices for the re-action, none of these circumstances are realized; the hurtful substances pass off in combination with hydrogen, or if they become oxidized, they find themselves in the presence of sulphuretted hydrogen, which draws them off in a state of combination. I have had, in effect, the occasion to demonstrate the truth of this hypothesis by an experiment after my first researches. It consisted in this: If a current of sulphuretted hydrogen and steam is made to pass over antimonious acid, or an inferior oxide of antimony, heated to a dull red, it is volatilized completely, and a reddish compound makes its appearance, exactly as in the trials with the ore of Monzaja. Numerous experiments repeated on the ore of Monzaja, at first by itself, and afterwards mixed with iron or copper pyrites, have confirmed my conjectures. With ore alone, I did not succeed in causing to disappear the last traces of antimony, but the mixtures of the ore with pyrites, gave no traces of either antimony or arsenic. The conclusion which may be drawn from these experiments is the following: it is possible to get rid entirely of the arsenic and antimony, contained in an ore, or a matt, by submitting these bodies to the action of steam in a close vessel, and in heating them at the same time to a sombre red, provided that they contain a proportion of sulphur capable of forming a quantity of sulphuretted hydrogen more than sufficient to draw off the whole of the hurtful substances in a state of combination.

With the ore of Monzaja, a proportion of 25 per cent. of copper pyrites amply suffices; the generality of copper ores, and also of matts, produced in the ordinary treatment, are in very favorable conditions for roasting by steam. These experiments, which might be called theoretical, cannot determine by themselves, the value of the process, for there is a long distance be-

tween an experiment in the laboratory, and an actual metallurgical treatment; they have, nevertheless, shown me the possibility of employing on a large scale a roasting furnace, founded on the principles enunciated.

Before undertaking experiments on a large scale, I wished to realize first as far as possible in a small way, the conditions of practice: for that end I constructed a small reverberatory furnace, by means of which I was able to roast at once, nine pounds of the Monzaja ore, mixed with 25 per cent. of copper pyrites, the whole being crushed. The furnace was of a peculiar shape, adapted to the special process in view, and the steam was supplied by a small boiler of a capacity of 10 litres, and conveyed by metallic pipes into each side of the furnace and directed on the ore, which was spread on the sole of the furnace in a layer of about one inch in thickness. The draught of the furnace was very carefully regulated by a variable opening in the door of the ash-box, while the door for the combustion was luted tight, the desire being to produce reducing gases, and not oxidizing. Finally after some approximations, I succeeded in producing in the furnace a non oxidizing gaseous current, which brought the ore to a sombre red heat. The steam thrown on the surface of the ore exerts its action, and when the admission of air is well-regulated, the production of the complex sulphurets, on which I depend for the success of the operation, may be expected. As regards the time necessary for the elaboration of a change in a large furnace, the results I have observed cannot determine exactly, but I believe the duration of the roasting will not much exceed that of the Galloi's furnaces. As to the result, it will be to drive off completely the arsenic and antimony, allowing, however, to remain, a certain proportion of sulphur, necessary to the production of the matt. A certain quantity of the Monzaja ore, roasted in my furnace, with 25 per cent. of copper pyrites, was reduced in a crucible, with a flux of *verre terreux* in order to proceed as nearly as possible, as in practice; a blade of iron served me as a reducing agent, and I obtained a button, which, on being analyzed at the Bureau of Assay of the School of Mines, gave the following composition:—

Sulphur,	0,02
Arsenic and Antimony,	0,000,1
Iron,	00,9
Copper,	0,88
Nickel,	traces.
	0,99

It is seen by this analysis, that a single roasting, in an apparatus necessarily imperfect, sufficed, nevertheless, to drive off almost entirely, the igneous matter. This result seems to me of

great importance, in reflecting on the difficulties experienced in the ordinary treatment, above all, for an ore containing more antimony than arsenic, and 28 per cent. of these two matters. I have made researches with regard to the value of my process, in the case of argentiferous copper ores. The experiments were made on an ore containing sulphuret of antimony, and copper pyrites, from Peru, and which contained 0,006 of silver. These are the results. 1st.—There are not formed any traces of metallic salts, (sulphates, antimoniates, arseniates). 2d.—There is no loss of silver in the roasting. 3d.—The silver is found alone in the metallic state, in the products of the roasting.

These three circumstances, render practicable direct amalgamation to the roasted matt: it suffices to mix in an amalgamating mill, the matt in powder with mercury, to procure all the silver. An intermediate operation will be necessary, if it is wished to take away at the same time with the copper, the silver contained in the copper ore, this will be the direct amalgamation of the roasted matt. The processes employed in Germany to avoid the use of mercury, are not applicable to ores strongly charged with arsenic and antimony.

There are several cases where roasting by steam could be employed; the uses of nickel are augmenting every day; the roasting of speiss is a very complicated operation, and without doubt, the employment of steam would facilitate the driving off of the arsenic and antimony; in the manufacture of zinc, doubtless, advantages could be derived. The treatment of blende is rendered very difficult, by the imperfection of the present methods of roasting. It is known that a considerable part of the sulphuret is transformed into the sulphate, and that is pure loss, for in the presence of charcoal, the sulphate does not give metallic zinc, but reproduces simply the sulphuret; now I have found that blende, roasted by steam, is transformed into oxide, without forming a trace of sulphate.

In conclusion, I have shown in this note what is the effect of steam on ores or matts of copper enclosing arsenic and antimony, on speiss, and on blende.

I have described the process I have employed in a small way, for the roasting. I have demonstrated the advantages that could be realized from its application to the treatment of copper ores. I have shown as a consequence of its use, the possibility of applying direct amalgamation to extract silver from copper ores, and the advantages of this operation. I shall publish hereafter, the fruits of my experiments, hoping to support by figures the economical results I have announced, and prove that in practice may be realized the two necessary conditions, amelioration of products, and economy in treatment.

ART. III.—PRODUCT OF THE MINES, SMELTING FURNACES, AND SALT WORKS, IN OPERATION THROUGHOUT THE AUSTRIAN EMPIRE.

AUSTRIA is the richest country in Europe in minerals. Scarcely one can be mentioned, excepting platinum, which is not found within her limits. It is this rich annual income from the earth which has sustained the nation amid all its pecuniary embarrassments. By pledging the revenues of her salt-works, for the payment of interest, the government has often entered the market and effected a loan, when those who were not familiar with her resources have considered such a thing as an impossibility, and regarded the public treasury as verging upon bankruptcy. It is for the purpose of illustrating this circumstance, and also for showing the immense financial power possessed by a nation rich in mineral resources, that we have entered upon this extended statement of the mineral products of Austria. It is a view of the subject of mining entirely novel to the American people, and which may perhaps lead us more justly to appreciate the magnificent and undeveloped treasures of our country.

GOLD.

Gold is found, under various circumstances, almost in all parts of the Austrian empire; but few of which can be mentioned, as not at least a nominal yield has been temporarily obtained from others. It is found partly in veins and partly as surface gold.

The average production for five years, from 1843 to 1847, presents the following results:—

Transylvania,*	53·3 per cent.
Hungary, ...	54·3 "
Salzburg,†	0·6 "
Tyrol,‡	0·25 "
Styria,§ Bohemia,‖ Illyria,¶ military frontiers,	0·25 "
	100·00

* Transylvania, called in German *Siebenbergen*, "the Seven Towns," is the most easterly province of the Austrian empire, having on the north and west Hungary and the Bukovina; east the Bukovina and Moldavia: south, Wallachia, from which it is separated by the main range of the Carpathian Mountains. Its area is 21,160 square miles, and its population in 1842 was 2,108,405. Its surface, mostly covered by ramifications of the Carpathians, and Mount Buschtch, near Kronstadt, is 8,700 feet in height. The most remarkable mineral product, says one writer, is rock salt, a bed of which extends from Wallachia, through Transylvania, to Galicia, covering a space of 570 miles in length, and from sixty to seventy miles in breadth; 1,500,000 cwts. are procured annually from mines: there are besides 150 salt springs. Gold, silver, iron, lead, copper, antimony, arsenic, mercury, alum, sulphur, nitre, gems, and marble are amongst the chief mineral products. Twenty-two

The product of gold by regular mining is chiefly obtained by imperial or government works—the former by washings by private persons, in Transylvania (by gipsies and native Romans), who, however, must bring the metallic gold to the Aerarial Exchange. Moreover, a considerable amount of auriferous ores, schliech, and smelting products, is also brought from private workings to the Exchange.

In the year 1847, the product of gold at the State works was obtained from the following sources:

YIELD OF GOLD IN MARCS.*

Government Works.	Out of Own or Imperial Ores.	From Exchanged Ores (Schleichs) and Smelting Products of Working Companies.	Total.
Bockstein, Rauris, Lend, towns of Salzburg, ...	89	—	89
Zell, in Zillerthal	20	—	20
Schemnitz and Kremnitz, . . .	1,225	454	1,679
Neusohl, . . . } Hungary.	10	—	10
Magurka, . . . } Hungary.	61	—	61
Nagabanya, . . . } Hungary. . . .	278	332	610
Zalathna, in Transylvania, . . .	792	436	1,228
Total, ...	2,475	1,222	3,697

gold mines are wrought, and nearly every stream in the country is auriferous. The southern part of the province comprises fourteen distinct races of people.

† *Saleburg*, formerly a duchy, now a circle in Upper Austria, lying between Styria, Tyrol, and Bohemia; area, 2,800 square miles. Its chief wealth consists in minerals, as the salt from the Northern, and the metals from the Southern mountains.

‡ *Tyrol*, a province of the Austrian empire, having east and south, Carinthia and the province of Venice; north, Austrian Italy; west, Bavaria, Leichtenstein, and Switzerland, of which last it forms an eastern prolongation. Area, 10,981 square miles, and population in 1842, 842,768.

§ *Styria*, a province called duchy of Austria, bounded east by Hungary, south by Illyria and Croatia, north and west by Upper Austria; area, 8,658 square miles, and population in 1845, 950,612. The surface is almost wholly mountainous, and mining the chief branch of industry.

‖ *Bohemia*, a division of the Austrian empire, forming the eastern part of the Germanic Confederation: bounded north by Saxony and Prussian Silesia; east, by Prussia and Moravia; south, by Lower Austria, and west by Bavaria. Its area is 20,000 square miles, and population in 1846, exclusive of military, 4,847,962. The produce of the mines, especially in precious metals, has been for centuries one of the principal sources of wealth; the chief mining districts are in the Erzgebirge, and the centre parts of the Fichtelgeberge.

¶ *Illyria*, a province forming the south-east corner of the German empire, bounded east and north-east by Styria; south and west by the Adriatic and Italy; north by Austria, Tyrol, etc. Area, 10,850 square miles, and the population in 1846, 1,252,831. Mining is the chief object of industry. Its mineral riches comprise gold, silver, mercury, lead, copper, and iron. Iron is most abundant in Carinthia and Carniola; lead, in the rich mine of Bleiberg; and mercury in Idria.

* 7,529 Vienna marcs — 9,035 Cologne marcs. The value of 1 Vienna mark of gold is 365 florins; 3·7 kreutzers, conventional money. The florin is 48½ cents, and the kreutzer $\frac{48}{100}$ of a cent.

Add to this, besides, 3,882 marcs, which are by companies and individuals brought to the Exchange in a metallic state.

Hence the total amount of the gold yield for the year 1847 was as follows:—

From Government works of their own ores,	32·9 per cent.
From exchanged ores, Schleich, and smelting products of, etc.	16·2 "
Companies, and private individuals, from exchanged metallic gold,	50·9 "

The entire product of gold has amounted to the following:—

Year.	Marcs.	Year.	Marcs.
1820	8,566	1840	6,800
1825	4,035	1845	7,189
1830	4,517	1846	7,607
1835	5,720	1847	7,529

The official accounts of the production of the last years are wanting; the condition of Hungary also must have prevented any increase in the total amount.

SILVER.

As Austria yields the most gold of any country in Europe, so, next to Spain, it yields the most silver.

The average annual yield for the years 1843 to 1847, in silver, was as follows:—

Hungary,	70,379 marcs, or	64·9 per cent.
Bohemia,	29,804 "	27·5 "
Transylvania,	5,794 "	5·2 "
Tyrol,	675 "	0·6 "
Military Frontiers,	601 "	0·6 "
Galicia,*	566 "	0.5 "
Styria,	437 "	0.4 "
	108,256 marcs.	100·00 per cent.

The yield of the Salzburg and Illyrian works is insignificant.

The product of the Aerarial works, for the year 1847, is distributed as follows:—

* *Galicia*, a province of Austria, bounded west by Silesia, south by Hungary and Transylvania, and east by Russia and Moldavia. Area, 33,538 square miles; population in 1842, 4,910,629. The minerals comprise marble, alabaster, sulphur, iron, coal, copper, zinc; but the most remarkable mineral production is fossil salt, the bed of which, in the salt-works of Wielicka and Bochnia, has been worked since the year 1300.

PRODUCT IN MARCS.

Government Works.	Of their Own Ores.	From Exchanged Ores, Schlaich, and Smelting Products of Companies.	Total.
Schemnitz* and Kremnitz, . . .	28,977	15,378	44,350
Neusohl, ...	1,922	407	2,329
Schmolnitz, ...	2,428	6,960	9,388
Nagabanya, ...	17,692	332	18,024
Zalathna, ...	2,278	2,378	4,651
Przibram, ...	28,086	123	28,209
Brixleg, ...	627	62	689
Bockstein, Rauris, and Lend, in Salzburg, ...	290	—	290
Total, ...	82,295	25,635	107,980
Add amount brought to exchange by companies, ...		7,751	7,751
	82,295	33,486	115,681

* *Schemnitz* was formerly a royal free city of mines, and the principal centre of the mines of Hungary. It lies twenty-five leagues north of Buda, 560 yards above the sea, in the midst of a small group of mountains. The most part of these mountains are formed of rough trap rocks; but at their foot, below the trachytic formation, a formation is observed, consisting of green-stone porphyries, connected with syenites, passing into granite and gneiss, and including subordinate beds of mica slate and limestone. It is in this formation that all the mines occur. The metalliferous rocks appear at Schemnitz only in a space of small extent, comprehended partly in a small basin, of which the city occupies the south border. They are traversed by veins, which for the most part cut across the stratification, but which also are sometimes obviously parallel to it. These veins are in general very powerful; their thickness amounting to even more than forty yards, but their extent in length seems to be equally inconsiderable. They are numerous, and parallel to each other. It appears that they have no side plates of vein stones, but that the metalliferous mass reposes immediately on the cheeks or sections of the rock, which is usually more or less altered, and includes always much pyrites near the point of contact, and even to a distance of several feet. The substances which constitute the body of these veins are drusy quartz, caseous quartz, ferriferous carbonate of lime, and sulphate of barytes, with which occur sulphuret of silver, mixed with native silver, containing more or less gold, which is rarely in visible scales; sulphuret of silver, argentiferous galena, blende, copper, and iron pyrites, etc. The sulphuret of silver and the galena are the two most important ores. Sometimes those two substances are insulated, sometimes they are mixed in different manners so as to furnish ores of every degree of richness, from such as yield sixty per cent. of silver down to the poorest galena.

The mode contrived, towards the middle of the 18th century, for working these thick veins is called the cross system of mining, which consists in forming galleries through a mineral deposit from its wall or floor towards its roof, and not as usual in the direction of its length. It is employed in many places with advantage, particularly in Idria, in Carniola, mentioned farther on.

Kremnitz lies about five leagues north north-west of Schemnitz, in a valley flanked on the right by a range of hills formed of rocks of quite an analogous character to the metalliferous rocks of Schemnitz. In the midst of those rocks veins are worked nearly similar to those of Schemnitz; but the quartz,

The yield of silver ore, therefore, in the year 1847, is—

From Government works of their own ores,	71·1	per cent.
From exchanged ores, etc.,	22·2	"
Amount brought to Exchange by companies,	6·7	" of the whole product.

In the period from 1820 to 1847 the product of silver in Austria was—

Years.	Marcs.	Years.	Marcs.
1820	62,575	1840	101,035
1825	81,016	1845	108,391
1830	84,545	1846	110,496
1835	94,715	1847	115,661

The latter yield equals 138,417 marcs Cologne.

Later returns of the yield of silver are wanting.

QUICKSILVER.

The largest part of the quicksilver produced by Austria comes from Idria, in Carniola. Its yield amounted in the five years, from 1843 to 1847, to 2,902 cwts. The product of the last year is shown in the following statement:—

Crown Lands	Government Works. Cwts.	Private Works. Cwts.	Total. Cwts.
Styria,	—	1	1
Illyria,	2,782	6	2,788
Hungary,	—	801	801
Transylvania,	—	51	51
Total,	2,782	859	3,641

which forms their principal mass, is more abundant, and contains more native gold. Here also are found sulphuret and hydro-sulphuret of antimony.

Neusohl is six leagues north north-east of Schemnitz. Its mines have been worked since the 13th century. Two leagues from Neusohl greywacke forms pretty lofty mountains: this rock is covered by transition limestone, and is supported by mica slate. The lower beds contain bands of copper, chiefly copper pyrites.

Schmolnitz is eighteen or twenty leagues east of Neusohl. The copper extracted contains about six or seven ounces of silver in the hundred-weight.

Nagabanya, on the north-east, comprises a group of mines, which lie in a somewhat considerable chain of mountains proceeding from the frontiers of Buchowina, finally disappears amid the saliferous sandstones of Transylvania. These mountains are partly composed of rocks analogous to those of Schemnitz, traversed by veins which much resemble those of that celebrated spot. Limestones, sandstones, trachytes, basalts, and syenite porphyries, quite analogous to those of Schemnitz, have been noticed. It seems to be principally in the latter rocks that the mines forming the wealth of this country occur; but some of them exist also in the mica slate, the greywacke, and even in the limestone. The auriferous ore is accompanied with galena, realgar, manganese, iron, and zinc.

Przibram is twelve leagues south-west of Prague, at the extremity of the mountains which separate Behrun from Moldau. The argentiferous galena is accompanied by blende, in which the presence of cadmium has been observed.

The product of former years was—

Years.	Cwts.	Years.	Cwts.
1823 . . .	2,163	1840 . . .	2,742
1825 . . .	3,177	1845 . . .	3,971
1830 . . .	2,433	1846 . . .	3,372
1835 . . .	3,777	1847 . . .	3,641

The yield of Transylvania is very fluctuating.

Only a small part of the production given for Hungary properly belongs here, as it refers to the mercury re-distilled from the amalgamation refuse of the Scholmitz district.

Besides, cinnabar is found in most parts of Hungary, although scarcely in workable quantities; also some mercury is contained in several *Fahleose* of the Schmolnitz district, which, by roasting through simple processes, is obtained.

In former periods, Horzowitz, and some other points in Bohemia, furnished quicksilver and cinnabar, although of late there are no accounts respecting them.

TIN.

The yield of tin is confined to the ore which appears naturally in the mountain chain between Bohemia and Saxony, on the south side of which the Bohemian tin mines are worked.

The yield from 1823 to 1847 was as follows:—

Years.	Governmt. Works. Cwts.	Private Works. Cwts.	Total. Cwts.	Years	Governmt. Works. Cwts.	Private Works. Cwts.	Total. Cwts.
1823	—	588	588	1840	50	987	1,037
1825	—	644	644	1845	47	949	996
1830	126	989	1,115	1846	57	945	1,006
1835	51	844	896	1847	39	938	977

The largest yield in this period of time was in the year 1843, which was 1688 cwts.

COPPER.

The production of copper is, in Austria as almost everywhere, closely connected with the production of silver, as in those ores, from which most copper is extracted (copper pyrites, gray ore), commonly silver in some degree is contained, or with the silver ore it is found associated. Hence it is apparent, that the yield of copper in the western crown lands increases or declines together with the silver.

The late increase in the production is to be less ascribed to the increased richness of the ores than to the improved methods in dressing, etc., and the improved use of the existing means. As, for instance, in the Schmolnitz district, there is now annually obtained 16,000 cwts. of cement copper from old accumulations around the mouth of shafts and old broken workings.

The average yield of copper for five years, from 1843 to 1847, has been as follows:—

Hungary,	41,026 cwts.	or 79·2	per cent.
Venice,	3,122	" 6·0	"
Tyrol,	2,918	" 5·6	"
Galicia,	2,116	" 4·1	"
Transylvania,	1,249	" 2·4	"
Styria, 856 Salzburg, 482 Bohemia, 16		" 2·7	"
Total,	51,785 cwts.	or 100·00	per cent.

In the year 1847 the yield under the government works was—

Government Works.	Of their Own Ores.	Of Exchanged Ores, Schlaich, and Products of Smelting Furnaces.	Total.
	Cwts. of Raw Copper.		
Bockstein, Rauris, and Lend,	372	—	372
Kitzbuhel,	1,851	—	1,851
Brixleg,	529	46	575
Agordo,	4,001	—	4,001
Neusohl,	3,850	760	4,610
Schmolnitz,	9,779	10,039	19,818
Nagabanya,	1,212	242	1,454
Total,	21,594	11,087	32,681

The private works, in 1847, sent directly to market,

In Styria,	769 cwts.
Tyrol,	867 "
Bohemia,	21 "
Galicia,	1,861 "
Hungary Schemnitz district,	254 "
" Schmolnitz "	16,198 "
Transylvania,	1,308 "
Total,	21,278 cwts.

Further yield of the private works in

Oravia, Szaszk, and Moldavia,	5,999 cwts.
Rezbanya,	223 "
Total,	6,222 cwts.

of raw copper in the metallic state for exchange at the government works there.

The product of private works in raw copper amounted, in the year 1847, to 27,500 cwts. According to the statement in the year 1847, the yield thereof is divided as follows:—

Government works of own ores,	35·9 per cent.
" " of exchanged ores,	18·4 "
From private works to the free market,	35·4 "
" " Exchange or Custom,	10·8 "
	100·00

From the year 1823 to 1847 the yield of copper was as follows:—

Years.	Cwts.	Years.	Cwts.
1823 . .	29,683	1840 . .	48,309
1825 . .	32,293	1845 . .	48,993
1830 . .	39,367	1846 . .	50,927
1835 . .	44,822	1847 . .	60,181

The report of 1848, and following years, on copper, tin, and quicksilver, is wanting.

LEAD.

The yield of lead stands in a two-fold connection with that of silver. Lead, in the first place, is almost exclusively extracted from galena; the richest and most common lead ore, is mostly argentiferous, and hence, also, is worked for silver. On the other hand, a large quantity of lead ores and metallic leads are used for the extraction of silver from the argentiferous copper or real silver ores. If, therefore, in some sections, by an increased production of lead, the yield of silver is increased, in others a considerable amount of lead is lost by the silver extracting process. The first occurs in Bohemia; the latter in Hungary and Transylvania. Hence it can be understood why the lead product of Hungary, in respect to the quantity and quality of ores worked, is so unimportant, and, in certain years, according to the variation in the silver extraction, is so different.

The products of lead working are known as—rich lead (*Reichblei*), marketable lead, litharge, and marketable lead ore. Rich lead is an intermediate product, from which, by further operations, silver and litharge are obtained. It, therefore, cannot be put down in this statement of the production. Marketable lead and litharge are produced in almost all the crown lands, but in very different quantities.

The yearly product of the empire was as follows:—

Years.	Lead. Cwts.	Litharge. Cwts.	Marketable Lead Ores. Cwts.
1823 to 1827 . . .	72,442	25,605	15,075
1828 " 1832 . . .	84,396	22,038	15,565
1833 " 1837 . . .	69,517	21,888	15,722
1838 " 1842 . . .	67,042	25,333	20,038
1843 " 1847 . . .	72,363	31,670	18,967
Average from 1823 to 1847,	73,154	25,307	17,073

The largest yield of lead occurred in the year 1828, which was 108,325 cwts.; and of litharge in the year 1846, which was 35,047 cwts.

The annual yield of each district of the crown lands amounted on the average, from 1838 to 1847, at the government and at the private works, as follows:—

Crown Lands.	Lead. Cwts.	Litharge. Cwts.	Marketable Lead Ores. Cwts.
Illyria,	59,145	—	—
Bohemia,	864	15,473	19,502
Hungary,	4,479	10,405	—
Tyrol,	2,273	152	—
Galicia,	219	507	—
Venice,	289	—	—
Military frontiers,	2,509	1,546	—
Styria,	unimportant.	315	—
Salzburg,	"	unimportant.	—
Total,	69,778	28,502	19,502
Of this, government works,	29 per cent.	87 per cent.	10 per cent.
" private "	71 "	13 "	90 "
Product in the year 1847,	66,917	29,952	16,821

The great portion of the lead product was uninterruptedly furnished by the rich mines of Bleiburg* and Raibl, in Carin-

* The celebrated lead mines of Bleiburg, in Carinthia, are in the ridge of mountains of compact limestone, in whose bosom the workings are carried on.

On considering the direction and dip of the marly schist and metalliferous limestone, it would appear that a great portion of this system of mountains has suffered a slip, whereby, probably, that vertical position of the strata has been produced which exists through a considerable extent. The metalliferous limestone is covered, to a certain thickness, with a marly schist and other more recent rocks.

The galena occurs in the bosom of this rock in flattened masses, or blocks of a considerable volume, which are not separated from the rest of the calcareous beds by any seam. It is accompanied by zinc ore (*calamine*), especially in the upper parts of the mountain. Of the workable masses, each presents itself as a solid analogous to a very elongated ellipse, whose axis dips, not according to the inclination of the surrounding rock, but to an oblique or intermediate line between this inclination and the direction of the beds of limestone. Everything indicates the contemporaneous formation of the limestone, and the lying beds of the lead ore.

The accidents or faults, called *kluft* (rent), at Bleiburg, are visible on the surface of the ground. Experienced miners have remarked that the rich masses occur more frequently in the direction of these accidents than elsewhere.

It is in general by galleries cut horizontally in the body of the mountain, and at different levels, that the miner advances towards the masses of ore. Many of these galleries are 500 fathoms long before they reach a workable mass. The several galleries are placed in communication by a few shafts; but few of these are sunk deeper than the level of the valley.

The total length of the mines at Bleiburg is about 10,000 yards, parallel to the valley; in which space there are five hundred concessions granted by the government to various individuals, or joint-stock societies, either by themselves or associated with the government.

The metalliferous valley contains 5,000 inhabitants, all deriving subsistence from the mines; 300 of whom are occupied in the government works.

Each concession has a number and a name; as Antoni, Christoph, Matthacus, Oswaldi, 2, 8, 86, etc.

Argentiferous lead mines have been mentioned at *Mies*, 25 leages W. S. W. of Prague, at the N. E. base of the western part of *Bomerwaldgebirge*, a chain of mountains which separates Bohemia from Bavaria. There are some

thia; the yield of which in metallic lead exceeded 85 per cent. of the whole product.

IRON.

The yield of iron in the various crown lands is, in quantity and quality, of great importance; and the iron founding business can be arranged in the following natural order, and according to the following groups or classes:—

1st. The Alpine group, with Styria, Carinthia and Carniola (both together form Illyria), Tyrol, Salzburg, Upper and Lower Austria, and Lombardy.

2d. The Sudeten group, with Bohemia, Moravia, and Silesia.

3d. The Carpathian group, with Hungary, Transylvania, Galicia, and the Military Frontiers.

The Venetian Provinces, the Maritime Frontiers, and Dalmatia, have no furnaces in operation.

Styria, of all the crown lands, produces the most iron, and that of the blast furnaces, in 1847, was—

	Pig Iron. Cwts.	Cast Iron. Cwts.
By government works, . .	357,280	21,013
" private " . .	487,792	4,965
Total, ...	845,072	25,978

Total of blast furnace yield, 871,050 Vienna centners or cwts.

In the year 1851, the production amounted as follows:—

	Pig Iron.	Cast Iron.
At government works,	317,699 cwts.	57,523 cwts.
" private "	536,078 "	4,005 "
	853,777 "	61,528 "
Total blast furnace product, .		915,305 cwts.

These large quantities of pig iron were almost exclusively made of spathic ore, of superior purity, taken (enblazen) principally from the famous deposits of the Erzeberg, between Eisenerz and Vordenberg.

In Carinthia is the most important point for the production of pig iron of the Erzeberg, between Huttenberg and Lalling.

also at *Przibram*, 12 leagues S. W. of Prague, at the extremity of the mountains which separate Behrun from Moldau. In the latter, the argentiferous galena is accompanied by blende, in which the presence of cadmium has been observed. These mines, and those of Joachimsthal and of Bleystadt, furnish annually at present 220,000 pounds avoird. of lead, and from 2000 to 3000 marks of silver. The circle of Behrun, to the S. W. of Prague, contains some inconsiderable mines of mercury. The eastern part of the Bomerwaldgebirge, which separates Bohemia from Austria and Moravia,, presents some mines on its S. E. slope. Those of the environs of *Iglau*, in Moravia, and some others situated in Austria, produce annually from 4000 to 5000 marks of silver.

The works are entirely in private hands. The production of the blast furnaces was as follows:—

1846, 622,608 cwts. and in 1851, 557,276 cwts.

Carniola produces, also at works in the hands of private individuals, annually 80,000 cwts. of pig iron.

Tyrol produced in 1847, from spathic and some magnetic iron ore, as follows:—

	Pig Iron.	Cast Iron.
At the government works,	47,708 cwts.	11,004 cwts.
Private works, . .	13,107 "	
Total, .	60,815 "	11,004 "
Grand total, . .		71,819 cwts.

Salzburg produced in 1847, from spathic, and brown hematite, as follows:—

	Pig Iron.	Cast Iron.
At government works, .	38,152 cwts.	3,221 cwts.
Private works, . .	12,594 "	—
Total, .	50,746 "	3,221 "
Grand total, . .		53,967 cwts.

In Lower Austria, the production of iron is inconsiderable, and amounted in 1847, to 28,576 cwts.

Lombardy produced chiefly from spathic, and red hematite, by works in private hands, in 1847—

Pig iron, ...	114,910 cwts.
Cast "	18,960 "
Total, . .	133,870 "
In 1849, . .	144,190 "

Bohemia produces from very different iron ores; red, and brown hematite, clay iron stone, sphaerosiderite, &c., which amounted in 1847, to:—

	Pig Iron.	Cast Iron.
At government works, .	61,513 cwts.	32,240 cwts.
Private works, . .	294,820 "	147,226 "
Total, .	356,333 "	179,466 "
Grand total, . .		535,799 "

Moravia and Silesia have only private establishments. In 1847, of red and brown hematite, and clay iron stone, they produced as follows:—

Pig Iron, ...	293,968 cwts.
Cast "	148,680 "
Total, .	442,648 "

Hungary produced in 1847, chiefly from red and brown hematite, as follows:—

	Pig Iron.	Cast Iron.
At government works,	183,231 cwts.	31,790 cwts.
Private works, . .	422,184 "	18,472 "
Total, .	605,415 "	50,262 "
Grand total, . .		655,677 "

Transylvania produced in 1847:—

	Pig Iron,	Cast Iron.
At government works	3,705 cwts.	1,389 cwts.
Private works . .	19,414 "	—
Total, .	23,119 "	1,389 "
Grand total, . . .		24,508 "

In the districts of the military frontiers, there was produced in 1847, by private establishments, 4,542 cwts. of pig iron.

In Galicia, finally, by private establishments, principally from sphaerosiderites, there was produced—

Pig iron	64,964 cwts.
Cast "	22,964 "
Total, .	87,928 "

The following table presents a summary of the production of pig iron and cast iron made in the various crown lands in the year 1847. Later returns are deficient hitherto:—

Crown lands.	Cwts. Pig Iron.	Cwts. Cast Iron.	Total of Blast Furnaces, cwts.
Lower Austria,	28,576	—	28,576
Salzburg,	50,746	3,221	53,967
Styria,	845,072	25,987	870,059
Illyria,	660,757	23,751	684,408
Tyrol,	60,810	11,004	71,819
Bohemia,	356,333	179,466	535,799
Moravia and Silesia,	293,968	148,680	442,648
Galicia,	64,964	22,964	87,928
Lombardy,	114,910	18,960	133,870
Hungary,	605,415	50,262	655,677
	23,119	1,389	24,508
	4,542	—	4,542
Total,	3,109,212	485,515	3,594,787

Of the above there was produced:

At Public works,	691,589	100,657	792,246
Private works,	2,417,623	384,918	2,802,541

In the year 1848, the production was 3,660,917 cwts. or, in round numbers 4 million Prussian centners, and there was thereof 22 per cent. from the government, and 78 per cent. from private establishments.

In the following years, the production averaged as follows:—

	Cwts.	Increase per cent. over the first period.
1823 to 1827,	1,377,874	
1828 " 1832,	1,617,799	17.4
1833 " 1837,	1,747,969	26.8
1838 " 1842,	2,410,851	75.0
1842 " 1847,	3,134,273	127.5
1847	3,594,787	160.9

However, these statements relative to private works are rather too low than too high, as, in general, it is very difficult from small works to obtain exact reports of the production.

There is at present in Moravia and Bohemia, only a comparatively small amount of pig iron manufactured by mineral fuel (coke). The fuel commonly used is charcoal. The Austrian pig iron is very good, but expensive, and as the present product averages only eleven pounds of pig iron to each inhabitant, it follows, that the domestic production must be increased, or, as this cannot be done at once, foreign pig must be imported. Hitherto this could not well be done, as the tariff, which was first reduced in 1852, still amounted to half a Prussian thaler per cwt. of pig. When, however, the commercial treaty of 1854 between Austria and the States of the Zollverein, takes effect, an important import of coke-manufactured pig will take place, under a duty of 1-16 of the Prussian thaler per cwt., on all iron shown to be of Silesian manufacture. The want of cheap pig iron for casting, is very much felt in Austria. In Styria the price of a cwt. of pig in May, 1853, was 3 florins, 24 kreutzers; and in Upper Silesia, a Vienna cwt. of coke pig cost 2 florins, 10 kreutzers. For the great iron producing regions in Upper Silesia, on the Ruhr in Westphalia, in the provinces of the Rhine, which can send their product to Austria by the Rhine, Maine, Maine-Danubian Canal and the Danube, this commercial tariff is of great importance. On the other hand, under the tariff of $\frac{2}{3}$ of a Prussian thaler per cwt., there will be imported a very considerable quantity of superior Styria steel into the Zollverein States; as, hitherto, under the duty of $1\frac{1}{2}$ thalers per cwt., there are imported 16,000 to 20,000 cwts. annually.

In the bar-iron and steel manufacture Austria has lately made important progress, which may be seen by the following average returns. Styria manufactures 500,000 cwts. of bar-iron; of which about 200,000 cwts. are rolled, and more than 100,000 cwts. hammered; also 120,000 cwts. of steel, chiefly smelted steel; likewise, puddled-steel, cement-steel, and cast-steel are manufactured.

In Carinthia are manufactured 150,000 cwts. of cast-iron, 200,000 cwts. puddled-iron, and 80,000 cwts. steel.

In Craniola the manufacture by the puddling process is not unimportant.

In Tyrol are manufactured about 30,000 cwts., and 3,000 cwts. of steel.

Lower and Upper Austria produce from its own and Styria raw iron, about 200,000 cwts bar-iron, and 30,000 raw steel.

In Lombardy the quantity manufactured amounts to about 100,000 cwts. bar-iron, and 250,000 cwts. superior steel.

Bohemia manufactures 230,000 cwts. bar-iron, of which 50,000 cwts. are manufactured by the puddling process.

Moravia and Silesia, about 180,000 cwts., 100,000 of which are puddled.

Hungary produces 300,000 cwts., a part of which also is puddled iron.

Particulars are wanting respecting the manufacture in Transylvania, Galicia, and the military frontiers.

Throughout the entire empire, the average annual product of later years is 2,400,000 cwts. bar-iron, including 600,000 cwts. puddled iron, and 280,000 to 290,000 cwts. of raw steel; —80,000 or 90,000 cwts. of which are exported.

ZINC.

The production of zinc in Austria has never reached considerable importance. In the year 1847 it was as follows:—

Crown Lands.	State Works. Cwts.	Private Works. Cwts.	Total. Cwts.
Illyria,	1,137	836	1,973
Tyrol,	2,005	1,710	3,715
Venice,	218	—	218
Hungary,	496	—	496
Total,	3,856	2,546	6,402

In previous years the product was as follows:—

Years.	Cwts.	Years.	Cwts.
1823,	1,176	1840,	1,900
1825,	1,889	1845,	7,054
1830,	552	1846,	7,516
1835,	—		

ANTIMONY.

The product of crude antimony in 1847 amounted as follows:—

	State Works. Cwts.	Private Works. Cwts.	Total. Cwts.
In Illyria,	—	253	253
In Hungary,	3,489	625	4,114
Total,	3,489	878	4,867

Years.	Cwts.	Years.	Cwts.
In 1845,	3,114	1846,	9,567

ARSENIC.

White arsenic glass was manufactured in private works in 1847 as follows:—Salzburg, 453 cwts.; Bohemia, 1042 cwts.: total, 1495 cwts. This was one of the most productive years, while from 1843 to 1847 the annual average was 1200 cwts.

Orpiment, natural realger, was formerly found at Tajowa, in Hungary, but not subsequent to 1840.

COBALT.

Cobalt ores are found partly as such, and partly, in Bohemia, as cobalt speise. They are sold to the blue paint manufactories. They are obtained in Hungary, and Styria, by private works, and in Bohemia at the government works.

The production has amounted as follows:—

Years.	Cwts.	Years.	Cwts.
1825, . .	18	1837, . .	2,654
1826, . .	23	1844, . .	2,579
1830, . .	969	1846, . .	2,395
1835, . .	876	1847, . .	3,113

Of the last amount, 78 per cent. was produced in Hungary, 17 per cent. in Styria, and 5 per cent. in Bohemia.

SULPHUR.

Native sulphur is found only in two places, in such quantities as to pay for mining, to wit:—Szwoszowice, near Wieleczka, and at Radabog, near Crapina, in Croatia. The government sulphur works at that place supply three-fifths of the whole product. The remaining product of sulphur is obtained by roasting sulphurets.

The product was as follows:—

Years.	Cwts.	Years.	Cwts.
1823, . .	9,569	1840, . .	20,753
1825, . .	11,045	1845, . .	19,812
1830, . .	13,450	1846, . .	22,321
1835, . .	21,958	1847, . .	25,551

The last amount was produced as follows:—

Crown Lands.	Government Works. Cwts.	Private Works. Cwts.	Total. Cwts.
Salzburg, . .	813	——	813
Styria, . .	——	224	224
Illyria, . .	——	56	56
Bohemia, . .	——	7,847	7,847
Galicia, . .	11,287	——	11,287
Venice, . .	1,078	——	1,078
Hungary, . .	4,186	——	4,186
Total,	17,424	8,127	25,551

COAL.

In the official report no distinction is made between anthracite and bituminous coal, both are united under the head of mineral coal (steinkohlen), hence a division of the various kinds is not possible.

The demand in the year 1847 was as stated in the annexed table:—

Crown Lands.	Government Works. Cwts.	Private Works. Cwts.	Total. Cwts.
Lower Austria,	——	1,382,250	1,382,250
Upper Austria,	——	256,850	256,850
Styria,	150,278	721,166	871,444
Illyria,	——	851,674	851,674
Transylvania,	——	75,881	75,881
Tyrol,	51,735	3,656	55,391
Bohemia,	21,121	7,455,532	7,476,653
Moravia and Silesia,	——	3,121,196	3,121,196
Galicia,	——	35,588	35,588
Dalmatia,	——	105,561	105,561
Lombardy,	——	218,188	218,188
Venice,	——	——	——
Hungary,	447,686	——	447,686
Total,	670,820	14,227,542	14,893,362

The product in different years was as follows:—

1823,	2,417,693 cwts.	1840,	8,453,925 cwts.
1825,	2,766,862 "	1844,	11,505,029 "
1830,	3,761,955 "	1845,	12,887,630 "
1835,	4,478,249 "	1846,	14,208,811 "

In the year 1848 the production reached, with the exception of Hungary, 17,000,000 cwts., and thus during the last ten years it has almost trebled. Nevertheless, most of the coal fields are only in the infancy of their operations, and are preparing for extensive works; there are also many districts which, in regard to their coal deposits, are by no means sufficiently explored, so that an important development of coal mining is to be expected. The reports of the production of many private works, chiefly in Hungary and Transylvania, are very unreliable, and the amounts stated in the above tables are in general rather too low than too high. As, for instance, that which is consumed about the mines by families, and for steam purposes, is never reported. It can therefore be said with some certainty, that the actual product of coal is greater than the reported product 20 or 25 per cent., and to the above named quantity of

17,000,000 cwts., are yet to be added:
4,000,000 " for too low statements,
1,000,000 " for Cracow,
1,000,000 " for Hungary and Transylvania.

So that 23,000,000 " may be regarded as about the accurate yield for 1848.

In the last years, and before the advance of the price of wood, the coal product had become quite important. The product of Styria is in the above tables for 1847, stated at 811,444 cwts. In 1851 it amounted to 1,581,704 cwts.

GRAPHITE.

This is of little importance in Austria, and considerable quantities are even exported to England.

In the year 1847 the production was:—

In Lower Austria,	1,457 cwts.
" Styria,	475 "
" Illyria,	885 "
" Bohemia,	23,165 "
" Moravia and Silesia,	5,456 "
Total,	31,432 "

The product was obtained at private works. In preceding years the production was as follows:—

1830	18,066 cwts.	1844	27,620 cwts.
1835	22,805 "	1845	15,486 "
1841	49,882 "	1846	19,708 "

ALUM.

In the Austrian territory, there is found excellent material for the manufacture of alum, not only as alum and coal-slate, but also in Hungary as alum-rock, likewise as native alum in Bohemia. The production of the private works was as follows:—

In Lower Austria,	592 cwts.
" Styria,	5,008 "
Maratime Frontiers,	804 "
In Bohemia,	4,750 "
" Moravia and Silesia,	2,587 "
" Hungary,	15,371 "
Total,	29,113

In preceding years the production was as follows:—

1823	26,960 cwts.	1840	26,456 cwts.
1825	28,250 "	1843	35,882 "
1830	29,329 "	1845	29,899 "
1835	22,076 "	1846	36,805 "

SULPHATE OF IRON, (GREEN VITRIOL.)

The production in the year 1847 was:—

Crown Lands.	Government Works. Cwts.	Private Works. Cwts.	Total. Cwts.
Upper Austria,	29	—	29
Maratime Frontiers,	—	841	841
Bohemia,	—	31,871	31,871
Venice,	12,107	—	12,107
Transylvania,	—	56	56
Total,	12,136	32,768	44,904

In former years the production was as follows:—

1823	37,223 cwts.	1842	95,616 cwts.
1845	38,458 "	1844	61,136 "
1835	40,177 "	1845	44,846 "
1840	49,559 "	1846	51,003 "

SULPHATE OF COPPER, (BLUE VITRIOL.)

The production amounted in 1847 to the subjoined quantities; therein, however, is not included that manufactured at the imperial mints, nor the zinc-vitriol product, as it is confined only to brass manufacturers, and is distinct from mining and smelting products.

Crown Lands.	Government Works. Cwts.	Private Works. Cwts.	Total. Cwts.
Salzburg,	688	—	688
Styria,	—	420	420
Bohemia,	—	5,424	5,424
Total,	688	5,844	6,532

In the preceding years the production was as follows:—

Years.	Cwts.	Years.	Cwts.	Years.	Cwts.
1823	281	1837	4,482	1845	5,381
1832	3,699	1840	4,451	1846	7,853

SALT.

The salt product in Austria, only so far as it is done by mining, is under the superintendence of the Mining Department; every other product of salt, together with its consumption, is under the charge of the provincial department of the government. Below, however, the entire production is given from authentic sources. Three kinds of salt are obtained, rock salt, brine salt, and sea salt, and the yearly production is controlled by the demand.

Rock salt is produced:—

First—as an incidental product of the salt deposits, in the Gmunden mining district (Hallstadt, Ischl, Aussee, and Hallein), also sometimes in the salt deposit near Hall, in Tyrol; in all these deposits the salt containing clay is extracted by well water, and the saturated solution evaporated.

Second—as chief product in the rock salt mines of Wieliczka and Bothnia, also in limited quantities in the mine and brine works at Kaczyka in Transylvania, in the rock salt mines in the Marmuros in Hungary, and in the Transylvanian salt mines.

Brine salt is obtained:—

First—in the table below named, brine salt works, which receive the artificial solution from particular salt mines.

Second—from the Galicia brine salt works, or *Cocturus*, also from the Hungarian salt works at Socobar, all of which work

brine from natural springs. Sea salt is obtained partly in the state saline at Stagno in Dalmatia, partly in the private salt yards on the mountain frontiers and Dalmatia. These private salines are, however, confined to those quantities which the State government annually prescribes.

The total production of all the salt works was:—

Years.	Cwts.	Years.	Cwts.
1823,	4,167,554	1840,	5,831,442
1825,	3,850,807	1845,	5,717,803
1830,	3,985,211	1846,	5,903,568
1833,	4,429,254	1847,	6,350,995

In the latter year this production was distributed as follows:—

Salt Works.	Rock Salt. Cwts.	Brine Salt. Cwts.	Sea Salt. Cwts.	Total. Cwts.
Grunnden,	6,831	767,022	—	773,853
Hallein,	4,719	212,324	—	217,043
Aussee,	2,945	243,395	—	246,340
Hall,	429	241,165	—	241,594
Wieliczka,*	1,002,310	———	—	1,002,310
Bohemia,	308,753	———	—	308,753
Gallizische bocturus,	14,399	508,326	—	522,665
Marmaros,	667,009	———	—	667,009
Transylvania,	1,591,478	———	—	1,591,478
Soovar,		126,997	—	126,997
Maritime Frontiers,			593,171	593,171
Dalmatia,			59,882	59,882
Total,	3,598,813	2,099,129	653,053	6,350,995

Summary of the entire product of the mines of the Austrian Empire in the years 1847 and 1848:—

Product.	1847.	1848.
Gold,	7,529 marcs.	7,507 marcs.
Silver,	115,681 "	124,395 "
Quicksilver,	3,641 cwts.	3,737 cwts.
Copper,	60,181 "	60,166 "
Tin,	977 "	891 "
Lead,	66,917 "	79,398 "
Litharge,	29,952 "	32,463 "
Marketable lead ore,	16,841 "	16,539 "
Zinc,	6,402 "	25,359 "
Pig iron,	3,109,212 "	3,217,046 "
Cast iron,	485,575 "	483,871 "
Sulphur,	25,551 "	25,822 "
Arsenic,	1,495 "	1,264 "
Antimony,	4,367 "	4,367 "
Cobalt ore,	3,113 "	3,563 "
Graphite,	31,432 "	36,927 "
Coal,	14,893,362 "	16,960,000 "
Alum,	29,113 "	——— "
Sulphate of iron,	44,904 "	——— "
Sulphate of copper,	6,532 "	——— "
Value of the year's product,		27,906,901 flor. C. M.
Common salt,		6,350,995 cwts.

* The celebrated mine of Wieliczka, which has been worked ever since the year 1253, lies in the north-western part of Galicia, and is but an inconsid-

Value of the product of the mines in the various provinces of the Austrian Empire in the years 1847 and 1848:—

	1847. Florins.*	1848. Florins.
Austria below the Ens,	318,355	250,505
" above " "	320,561	315,970
Styria,	3,500,750	3,445,450
Illyria,	4,077,337	3,947,349
Maritime Frontiers,	17,761	16,040
Tyrol,	540,447	437,197
Bohemia,	4,871,379	4,894,926
Moravia and Silicia,	2,501,105	2,478,787
Galicia,	552,651	875,378
Dalmatia,	15,634	23,063
Lombardy,	572,504	527,089
Venice,	237,739	228,049
Hungary,	8,729,594	returns
Transylvania,	1,703,401	wanting
Military Frontiers,	207,491	
Total,	28,167,089	17,439,913

Moreover a statement is wanting of the number of workmen occupied in the mines and furnaces of Austria; but any one can form an idea of it by looking over the following statement of the workmen directly and indirectly employed at the iron works:—

Miners engaged in raising 10,000,000 cwts. of ore,	13,340
Workmen at blast furnaces,	15,889
" manufacturing cast iron,	3,330
" " bar iron,	11,421
" " steel,	998
" employed in the larger iron and steel manufactories,	12,755
" " in small workshops,	60,000
Cartmen, etc.,	29,150
Total,	146,883

The reader can discern in these concise summaries of the production of the Austrian mines, their great importance at present, and that the mining and smelting business in those extensive countries must have an important future. The government withholds any means to accomplish this purpose. We are indebted for these statements to the "Mining productions of the Austrian Empire, compiled by Franc Friez, Vienna, 1852,"† etc.

erable inroad upon a mass of rock salt extending for a length of nearly 600 miles.

* The florin is 48¼ cents.

† Die Bergwerks—production der österneichisen Monarchie, Nach amtlichen Quellen übersichlich dangestellt von Franz Friese, Wein, 1852. Mittheilungen über Handel Gewerbe und verk ehrsmittel, sowie aus dern Gebiete der Statistick überhaupt; nach Berichten des K. K. Handels ministeriums. Herausgegeben von der Direction der administrat. Statistick. Wien, 1850.

ART. IV.—EXAMINATIONS AND EXPLORATIONS ON THE GOLD-BEARING BELTS OF THE ATLANTIC STATES.*

THE REID MINES, NORTH CAROLINA.

The tract on which these mines are located contains 774 acres of land, and lies in Cabarrus county, North Carolina, thirteen miles from Concord, the county-seat, twenty miles from Charlotte, and within ten miles of the North Carolina Railroad, on the western slope of that ridge of the chloritic talcose slate formation, which is specially called the slate belt, and the auriferous veins of which, until now, have proved to be exceedingly productive and reliable. The same belt embraces a number of gold mines, that either are renowned for their extreme richness in former days, or are now in successful operation: viz., Gold Hill, the Davis, Louis, Washington, and Huey Mines, North Carolina; the Hale and Brewer Mines, South Carolina, etc.

The Reid mining property bears that characteristic feature which at once would strike the miner's eye, and make him feel certain that there must be something under ground worth toiling for. It has principally four different hills on it, each containing one or more metalliferous veins, which may be traced by surface indications for half or three-quarters of a mile within the boundaries of the tract. The former operations at these mines were confined to what is called the Upper and the Lower Hills, and to the deposits of auriferous gravel around their base. At both hills extensive underground works have been performed, and the yield has been enormous.

The Upper Hill is traversed by a cluster of numerous auriferous quartz veins, which bear a general course of north 35° east, and are, on the top of the hill, intersected by a cross vein, running north 85° west. These veins, after also traversing the Middle Hill in their south-west direction, cross the Little Meadow Creek at that point where it forms into a small lake, supplied by never-failing springs, which originate from the water filtrated through the veins down the hill. This natural sewer appears to be the cause of the remarkable dryness of the underground works at the Upper Hill, a circumstance that so much aided the former development of this mine, and so advantageously facilitates the present operations. The Lower Hill also contains a cluster of auriferous quartz veins, which certainly are not the same with the Upper Hill veins, but join them at the top of that hill. They have a course of north 15° east, and in their south-west direction, also crossing the creek, extend through the hill on which the old Reid mansion-house is situated. This hill, being entirely cleared and under cultivation, gives sufficient

* Continued from page 388, Vol. II.

evidence of the mineral treasure which it conceals. The veins in it are cropping out at several places, and pieces of gold have frequently been picked up on ploughing. Yet still there has been no opening made, and all is left to future explorations. West of these hills there lies another one, or rather an elevated ridge, on the back of which large and extensive outcroppings of a lode are apparent. Recently some prospecting works have here been commenced, and from a depth of only a few feet splendid specimens of copper ore were obtained. We have traced this vein for a considerable distance in a course of north 35° east (parallel to the Upper Hill gold veins), and occasionally found small pieces of copper ore on the very surface. In our opinion, this lode demands particular attention. On the western slope of this "copper ridge" there is another vein, which has been opened by a few pits, and yielded promising specimens of argentiferous and probably also auriferous galena. By tracing the course of this vein, we noticed a variation of north 5°, 10°, 20° east; and considering its relative situation, together with the fact that galena has also been met with in workings on the cross vein at the Upper Hill, it becomes very probable that the vein is not an independent one, but the western extension of the cross vein, which forms a curve, and changes into the regular north-east and south-west course of the veins in this region. There are still indications of other veins on the eastern portion of the estate, which, however, do not show themselves sufficiently distinct on the surface to determine their course, and need exploration to detect their character and value.

The Reid Mine has obtained an historical celebrity as being the first gold mine discovered and worked in the United States, and the only one in North America from whence, up to 1825, gold was sent to the Mint. The discovery of gold on this property, from the most authentic sources,* happened in the following manner:—

In the year 1799, Conrad Reid, a boy about twelve years of age, and son of John Reid, the proprietor, went, in company with a sister and a younger brother, on a Sabbath day, when their parents were at church, to a small stream called the Little Meadow Creek, for the purpose of shooting fish with a bow and arrow. While engaged along the bank of the creek, Conrad saw

* Viz., the statements of Arthur and Timothy Reid, grandsons of John Reid; the testimony of George Barnhardt, a son-in-law of John Reid, in "Wheeler's Historical Sketches of North Carolina," Vol. II., p. 63, etc. John Reid was born in Germany, and was one of the Hessian soldiers who by their noble prince were sold to England to fight against the Americans. Reid feeling too indignant to shed his blood as a willing tool in such an unjust cause, made at Charleston his escape. He was, however, caught, and received "thirty-nine." Afterwards, they sent him off, with the advice "to go to the d—l." Reid went to Cabarrus county, and became the owner of the "bull of gold mines," as it vulgarly was called.

a yellow substance shining in the water. He went in and picked it up, and, finding it to be some kind of metal, carried it home and showed it to his father. Mr. Reid examined the piece, which was about the size of a small smoothing iron (and is said to have weighed about 17 lbs.); but not thinking of gold, he could not make out what sort of metal it might be, and put it, on account of its weight, on the house-floor against the door, to keep the same from shutting. Some time after, Mr. Reid carried the piece to Concord, and showed it to a Mr. William Atkinson, a silversmith; but he also, not thinking of gold, was unable to say what kind of metal it was. Mr. Reid then kept the piece as a "curious rock," for several years on his house-floor, to lay against the door. In the year 1802 he went to market to Fayetteville, and, advised by some persons living in the neighborhood, he again carried the mysterious piece of metal with him, and showed it to a jeweller, who immediately told him it was gold, and requested him to leave the piece with him that he might "flux" it. Mr. Reid left it, and returned in a short time; and, on his return, the jeweller showed him a large bar of gold, six or eight inches long, and asked him what he would take for the bar. Mr. Reid, not knowing the value of gold, thought he would ask a "big price," and so he asked three dollars and fifty cents! The jeweller paid him his price.*

After returning home, Mr. Reid conjectured that there might be found more gold in or about the creek, and, on examining the surface near it, his supposition was confirmed by his finding nuggets in the gravel. He then associated Frederick Keiser, James Love, and Martin Pfeifer, with himself, for the purpose of digging and selecting the gold along the creek. They were highly successful in their operations, and obtained many pieces, from the smallest particles up to lumps of a weight of sixteen pounds. The whole surface along the creek, for nearly a mile, proved to be interspersed with the precious metal. In the year 1803, a negro boy, called Peter, then belonging to James Love, and at present living as Old Peter on a plantation adjacent to the mine, dug out of the gravel on the north-west side of the "lake" a lump of gold that weighed twenty-eight pounds avoirdupois. In the following year, besides a large amount of "grain

* The following little incident might throw some more light upon the state of society, half a century ago, in this section of country. After having received such a pile of money for nothing but a piece of metal accidentally thrown in his way, Mr. Reid thought of pleasing his wife by bringing her something which she often had heard of, but never known or tasted: he bought a few pounds of coffee. His wife being much pleased with this novelty in her kitchen department, went to prepare a fine meal; but soon she felt induced to reproach her husband for being cheated with his coffee, because she could not get it cooked. She had put the coffee, without being crushed, into water together with some meat, and tried to cook it like common beans.

gold," lumps of 9, 7, 3, 2, and 1¾ pounds were found. The selection and amalgamation of the smaller particles was performed in common hand rockers.

As the gold in and near the Little Meadow Creek originated from the outcrops of the veins on the western side of the Upper and Lower Hills, one would suppose that the former operators, by the progress of their workings and "trial pannings," soon were led to the original deposits so near by; but as they did not possess the slightest knowledge of mineral veins or mining, and were content with their rich and easy earnings, the veins remained untouched for many years, until, in 1831, Isaac Craton sunk the first pit at the Upper Hill. His success attracted the attention of his co-operators, and within a few years at the Upper Hill, as well as soon after at the Lower Hill, a number of shafts were sunk, varying in depth from twenty-three to ninety feet; galleries were driven on the course of the veins, and tunnels across them. Near the principal shafts horse-whims were erected, and a drag mill was put up near the creek for working the ores. The almost fabulous productiveness of these mines may be comprehended from some facts, related and confirmed by disinterested persons who formerly worked there, and in whose statements we found reason to confide.

Isaac Craton, in sinking the shaft named after him, struck a vein nearly five feet wide, and yielding five dollars per bushel; he also met with a string of eight inches in thickness, yielding from two to three hundred dollars per bushel. On account of his success, however, he was driven out of his shaft by Timothy Reid, who then extracted eighteen or twenty thousand dollars' worth of gold from it. After tunnel I. at the Lower Hill was driven 140 feet through solid rock, the first day's work, on striking the vein, reimbursed the whole expenses of the tunnel. T. Reid obtained there in one day three bushels and a half of ore, which yielded as many pounds of gold; and John Craton brought out of it at one time half a peck of ore, that gave 780 dwts. In the Brown shaft, I. Craton got a piece of gold of ten pennyweights; he also raised there a quantity of ore yielding 250 or 300 dollars per bushel. Thirty-six feet north 67 west from the Osborne shaft, there is a surface excavation about eighty feet in length, and from three to seven feet deep, where they dug the gold "like potatoes." Many times, after a stroke with the pick, lumps of gold would stick on it. Captain Bigger once saw dug out there a piece of twelve pounds' weight, besides numerous others, weighing several pounds. They accounted altogether about 160 pounds of gold obtained from these diggings; yet perhaps an equal amount was concealed or stolen at night by the negroes. A man in Concord bought, from different parties working at this place, three pieces of gold which fitted together, and had, with a fourth piece missing, formed one single lump. The three

pieces weighed sixty pounds. Robert Motley, who now owns a large plantation, commenced working at the Reid mines as a day laborer, and says, that all the property he has was the result of his work at the mines. On one day he obtained fourteen pounds of gold before breakfast, and five pounds more before night. Captain Bigger stated that he was sure of having worked more gold at this mine than his own weight, and that the gold obtained by all parties could not be carried by six horses. At the surrounding groceries and liquor shops, the negroes employed at the mines used to exchange for a pint of brandy or whiskey a pint of gold, which they abstracted from their masters, or collected at night; for a single "drink" they gave pieces varying from the size of a pigeon's to that of a hen's egg, and considered it quite a favor to have some sugar thrown in. The hands hired by the mining parties were paid with pieces of gold pounded up in a common hand mortar.

The thriving success, however, with which the operations at these mines were carried on finally led to their cessation. Up to the year 1835, the mines were actively worked under leases, held by several parties, when difficulties arose amongst them, and a suit in Chancery was instituted. An injunction followed, which was litigated for over ten years, during which time all operations were suspended. In this interim, the original proprietor, John Reid, died, and left his estate to numerous relations. The property then came into the possession of different parties, but was never worked again to any extent until purchased by the present Company. At the time that operations were suspended, the mines were in a very prosperous condition, and the veins highly productive. The Lower Hill is said to have daily yielded from four to six pounds of gold.

In regard to the old workings of these mines, it deserves to be mentioned as a matter of considerable importance, that most of them have been performed with a striking skill and judgment, although there was no previous mining knowledge among the operators; and they may be considered as valuable explorations and improvements, saving the present Company the trouble and expenses of prospective openings and preparatory "dead work," and having enabled them to commence raising ore at the start, without doing any "rape work." It is seldom that such a commendation can justly be applied to mines in this section of country.

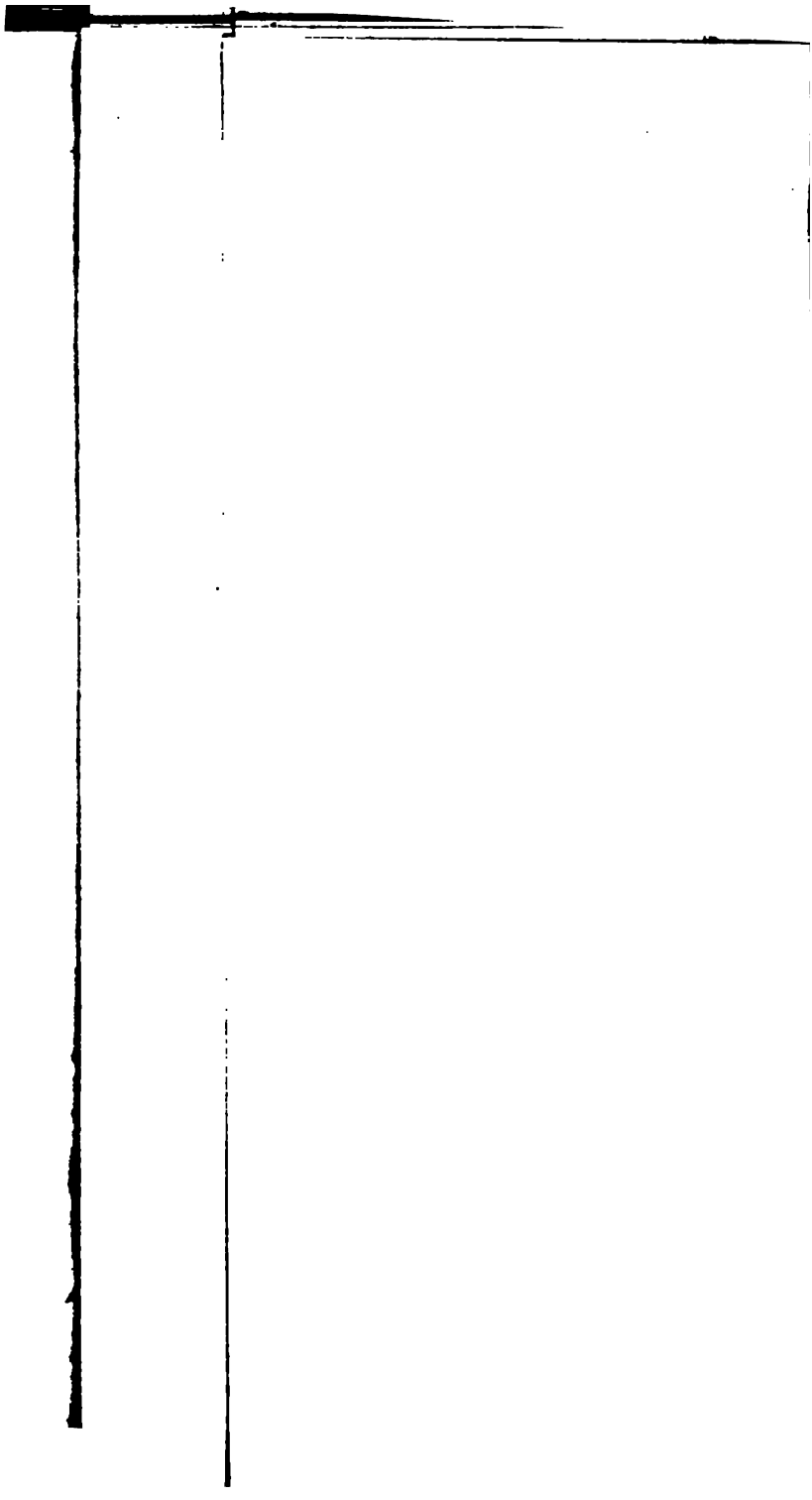
The following statement will show the amount and extent of works performed, and the present condition of operations at the Reid mines:—

At the Upper Hill there are twelve shafts of the added depths: Engine shaft 110 feet, Morgan shaft 50 feet, Craton shaft 86 feet, Linker shaft 60 feet, Hartzel shaft 80 feet, Arthur shaft 35 feet, Erwin shaft 55 feet, Timothy shaft 75 feet, Bigger shaft 32 feet, Osborne shaft 30 feet, Armstrong

shaft 25 feet, Genet or Line shaft 60 feet. The depths
some other shafts, which are partly caved in, could not be
certained. From the bottom of the Morgan shaft a cross-cut
driven south 68° east 78 feet long, where it forms an elbow a
runs into the Engine shaft at a depth of 62 feet. In this tun
number of veins and leaders are cut, of the appearance of w
a general idea may be formed from the adjoined dra
Their dip varies from 50 to 70 degrees south-east. On som
these veins galleries are driven in opposite directions, which
being continued by the present Company, who have raised
are raising quantities of rich ore from these workings. The
tension and direction of these galleries are as follows:—Gall
I. (nearest to the Morgan shaft), 10 feet north 28° east; gal
II. 30 feet north 46° east, and 31 feet south 35° west; gallery
67½ feet north 28° east and about 140 feet south 15—28° we
communicating with the Linker shaft; gallery IV. 68½ feet n
30° east and 83 feet south 30° west. At the elbow of the Mo
cross-cut there is a vein exposed, which measures from one
two feet in thickness, having an inclination of 52° south-
and is called the "rich vein." It runs through the Engine sh
and is worked on by several galleries to an extent of about
feet north 190 east, and 97 feet south 28° west from the sh
At a depth of 50 feet a small vein drops into the Engine sh
leaving it at about 80 feet, which is said to be extremely rich
gold. By sinking this shaft to a greater depth, for which p
pose the Company are actively at work, all the veins exposed
the cross-cut will be struck at points where they have join
and increased in thickness, and an amount of ore may there
developed exceeding the most sanguine expectations. At t
bottom of the shaft, the vein worked on in gallery IV. has
ready been struck. West of the Morgan shaft, the cross-cut h
recently been extended for about 20 feet, and several other n
veins and leaders have been explored.

There is an old cross-cut east from the Engine shaft, whi
should also be cleared out and extended, as there is much pr
ability that some new front veins would be discovered. Fr
the Hartzel shaft a gallery was driven south 26° west for abo
60 feet on a vein six or eight feet wide, which yielded from fi
to fifteen dollars per bushel. In the Timothy shaft a tun
was worked towards the "rich vein," but Timothy Reid bei
hurt in it by blasting, when he had already so far succeeded
to be yet perhaps a few feet from the vein, this work was ab
doned. In order to explore the Cross Vein, tunnels have be
driven from the Bigger to the Armstrong shaft, whereby the v
is cut. It has a thickness of several feet, dipping 35° south-we
and deserves to be opened a greater depth.

At the Lower Hill there are nine shafts, five of which are
the added depths:—Gilbert or Upper Whim shaft 100 feet, P



selt or Lower Whim shaft 60 feet, Sider shaft 80 feet, Brown shaft 40 feet, Harrison shaft 80; the depths of the Frederic, Eagle, Bird and Pigeon shafts being unknown. There are also three tunnels or level adits driven from opposite directions into the hill, communicating in the centre by galleries. Tunnel I. runs from the east side of the hill north 50° west, up to the gallery connecting the Gilbert with the Posselt shaft, and cuts a fine vein near its end. Tunnel II. is driven from the south side on the course of the veins up to the Brown shaft, that again by a gallery communicates with the Posselt shaft. Tunnel III. extends from the west side up to the gallery, which leads from the Gilbert to the Sider shaft, and a branch of it runs into the Pigeon shaft. The operations at the Lower Hill not being yet recommenced, the old workings were not accessible for a close inspection, and we shall more fully report on them when they are reopened. Near the Gilbert and Posselt shafts two whim houses are remaining in a condition to be easily repaired. The common ore of the Lower Hill veins averaged from three to five dollars per bushel; a fair inducement for clearing the old workings and driving on in them with new vigor.

A great improvement of the underground works at the Upper Hill by the present Company, was the enlarging and retimbering of the Engine shaft in a very superior manner. One of Worthington's pumps was placed in it, which works admirably. There are now a number of hands engaged in sinking this shaft farther down, partly for the purpose of exploring and partly in order to obtain more water for the mill, a plentiful supply of which will be got as soon as the bottom of the shaft shall be lower than that of the creek. Near the shaft a large and substantial whim has been erected, which is now in constant motion. A steam engine of fifty horse power is employed to work four sets of stamps, three large circular mills, one drag mill, and a set of shaking tables. The number of stamps will soon be increased, and in the mill-house, which has lately been erected, there is sufficient room for other additional machinery. A new office and store building, and a number of miners' cabins, have also been erected, and it is the intention of the Company to inclose the entire works at the Upper Hill by a high stone wall, like that at the Jesus Maria Mine, in Mexico.

In reference to the nature of the mineral ground of the Reid Mines, a remarkable circumstance has to be mentioned, which we also have had occasion to notice at other gold mines in the Atlantic States, namely, that the gold is not confined to the veins, but also found to a certain amount in the accompanying rocks. The gangue of these mines consists of porphyry, which is interspersed with auriferous pyrites, and a trial should be made in order to decide whether it would pay to work this gangue, large quantities of which are laying about the shafts.

Besides working the veins, the Company will find it to be a remunerative employment to work some portions of the auriferous gravel around the base of the hills, and also the piles of refuse ore and tailings near the old workings. The sand and gravel along the Little Meadow creek has repeatedly been worked over, and is still yielding gold when carefully washed. But there are tracts remaining which never have been worked, although from their relative position it must be concluded that they would yield as much gold as any others, however rich they might have been. Such a tract for instance, is the low ground on the west side of the Upper Hill close to its base.

In conclusion we would advise the Company to continue the prospective works upon the upper vein on the western portion of the property. Its rich and regular appearance on the surface, and the results already obtained, bid fair to strike, at a moderate depth, a magnificent copper lode. Explorations should also be made at the Middle Hill, which is penetrated by the Upper Hill veins, and has never been opened.

At these extensive mines there is ample room for five hundred miners to be employed in productive work; and under the assistance of Mr. Posselt, from the Jesus Maria Mine, of Mexico, whose services the Company have been very fortunate to secure, we doubt not the property will rapidly advance to the front rank among extensive and valuable mines.* A. P.

THE DESULPHURIZATION OF METALLIFEROUS SULPHURETS, OR DR. H. HOLLAND'S PATENTED PROCESS.—By O. M. Lieber.

The desulphurization of metalliferous sulphurets, that is to say, the removal of the sulphur from sulphurets which contain metals, especially the more valued ones, in a sufficiently cheap and rapid manner for practical purposes, has for some time been a puzzle to technical men, but I am of opinion that Dr. Holland has discovered the means of effecting this object without loss of time and in the most economical manner. Having, at Dr. Holland's request, examined into the feasibility of his new application, both theoretically and practically, I have arrived at the firm conviction that he has discovered a method that will prove of the greatest importance to metallurgical operations.

When properly applied,—and a very moderate heat only is necessary,—the sulphur is entirely removed, the gold exposed to the action of mercury, and the copper, if present, as is so generally the case in our Southern ores, entirely converted into a soluble salt, and as such is capable of being extracted at a very

* An account of the returns of the Reid Mines since the new mill was started, and also of the yield of the different kinds of ore, will be given hereafter.

trifling expense, even when present in very minute quantities, by means of galvanic precipitation with iron. In addition to this, the sulphurous acid cooled may be readily converted into sulphuric acid, and this alone will pay for the whole operation. Few technical processes combine such thorough application of chemical principles and complete practicability.

Every one who has engaged in treating the primitive gold ores is well aware of the great inconvenience resulting from the presence of sulphur in gold ores. The evil results are the following:

1. Covering the gold and preventing its exposure.
2. Flowering mercury and thus preventing amalgamation.
3. The sulphur being in combination with gold, and thus preventing its being acted upon by the mercury.

Such effects are too great to be ignored or dealt with lightly, and we most joyfully hail an invention which proves itself efficient in removing all the difficulties which have presented themselves.

The process, as I have already remarked, is based upon very simple chemical effects and reactions. Therefore my first object will be to explain the theory of its application and the action which takes place.

Anhydrous nitrate of soda consists of one equivalent of nitric acid and one of soda, the oxide of sodium, and has the formula $Na\,O + N\,O_5$, or in other words it is composed of one equivalent of sodium, one of nitrogen, and six of oxygen. The equivalent numbers for the different ingredients are as follows:

Sodium (Na)	= 287·435
Nitrogen (N)	= 175·060
Oxygen (O)	= 100·000

but of oxygen there are six equivalents present, therefore we have the following composition:

1 equiv. Sodium, ...	287·435
1 " Nitrogen, ...	175·060
6 " Oxygen, ...	600·000
Then for the whole compound we have .	1062·495

as the equivalent number or combining proportion. But none of these elements act separately in the process of decomposing sulphurets. It is five equivalents of the oxygen combined with the one of nitrogen, forming nitric acid, which alone are effective, and we must therefore regard the composition in the following manner:

Oxide of sodium (soda) Na O has the equiv. no.	387·435
Nitric acid $N\,O_5$ " " "	675·060
	1062·495

To find the percentage of nitric acid in pure nitrate of soda we

say, 1062·495 : 675·06 :: 100· : 63·524, which is a very large proportion, being more than 3-5ths. This large amount of nitric acid in nitrate of soda is one of the causes which makes it preferable to the nitrate of potash, which only contains 53·410 per cent. of nitric acid, or more than ten per cent. less than the former.

To ascertain in what manner the nitrate of soda acts in disengaging the sulphur from the elements with which it is united in the mineral, as well as to determine in what quantity it should be used, it will be necessary still farther to study its constitution. I have already remarked that nitrate of soda has the formula $Na\,O + N\,O_5$, that is to say, one equivalent of nitric acid is united with one of soda, thus forming one of nitrate of soda, and the nitric acid is again formed of one equivalent of nitrogen with five of oxygen, while the soda consists of sodium and oxygen, one equivalent of each. Now when one equivalent of nitrate of soda is mixed with one of sulphur, and thus ignited, one equivalent of sulphate of soda, one of nitrogen, and two of oxygen, are produced, or by formula, $Na\,O, N\,O_5 + S = Na\,O, S\,O_3 + N + 2\,O$. If we ignite together one equivalent of nitrate of soda and two of sulphur, we have $Na\,O, N\,O_5 + 2\,S = Na\,O, S\,O_3 + N + S\,O_2$. The equivalent number of anhydrous nitrate of soda, as already stated, is 1062·495, while that of sulphur is 200·75. If we therefore use one equivalent of the nitrate for two of sulphur, which is sufficient, we have a mixture whose united equivalent is $200{\cdot}75 \times 2 + 1062{\cdot}495 = 1463{\cdot}995$ —so that we require 114 parts of the anhydrous salt for the entire oxidation of 100 parts of sulphur. This sum seems very large at first sight; but we must recollect, in the first place, that only a small portion of the ores are sulphurets, and that by far the largest proportion is matrix; and, in the second place, that only a portion of the sulphurets again is sulphur. To find out how much nitrate of soda we should use for a certain ore, we must determine what amount of sulphuret there is present, and also what sulphuret we have to deal with. By treating the ore with powdered glass and borax, we ascertain, as usual, the amount of sulphurets present, and afterwards we can ascertain by analysis what metal or metals we have as sulphuret, and in what quantities they occur. This is a matter of importance as to the necessary quantity of nitrate of soda to be used, for the proportion of sulphur is very different in the various sulphurets; thus we find

Bisulphuret of iron $Fe\,S_2$ to contain sulphur, . .	53·39
Disulphuret of copper $Cu_2\,S$ (copper glance), . .	21·25
Common yellow sulph. of copper $Cu_2\,S, Fe\,S_2$, . .	35·37
Barnhardsite of genth $Cu_2\,S, Fe_2\,S_3$, ...	30·58

To ascertain the extent in which the different sulphurets of baser metals are auriferous would require a series of investigations, to engage in which I should not be able to find time at

present, nor is this a suitable place to enter upon a discussion of the kind.

The sulphuret of iron appears to be the most important as a solvent of gold, if I may thus apply the term; but the yellow sulphuret of copper, as well as the new mineral, the Barnhardsite, which occupies so prominent a position among the copper ores of North Carolina, both contain gold in appreciable quantities. The former sulphuret occurs frequently in crystals, while the two latter are generally amorphous.

Our calculations have hitherto been confined to the anhydrous nitrate of soda, but the crystalline substance, which contains one equivalent of water, and therefore has the formula Na O, N O_5, H O, is the shape in which it is brought into the market. The per centage of water is therefore 10·24 in the pure hydrated salt. In addition to this, however, hygroscopic moisture is readily absorbed; indeed, it frequently becomes liquid from being dissolved in the water so obtained, as three parts of water are capable of effecting its solution at the moderate temperature of 60 degrees of the Fahrenheit thermometer. The crude nitrate of soda of commerce is also very commonly slightly adulterated, from its native source, by nitrate of potash and chloride of sodium, salts which, although they exert no deleterious influences in themselves, still weaken the power of the nitrate of soda. All these things must be borne in mind by the practical operator, so that he may increase or diminish his quantities according to their purity. The quantity of nitric acid in the crude nitrate of soda —(and that contained in the possible admixed saltpetre is equally effective, though not as abundant)—may be determined in the same way as we would with nitrate of potash, by ascertaining how effectual it is in converting protochloride of iron into the perchloride. Chloride of sodium may be determined, if that be desirable, by precipitating the chlorine with nitrate of silver, and then calculating the amount of sodium with which it is combined.

TABLE SHOWING NECESSARY AMOUNT OF PURE HYDRATED NITRATE OF SODA, AND VARYING PERCENTAGES OF SULPHURET IN ORE.

When percentage of Sulphurets in Ore is	When we have Bisulphuret of Iron.	When we have Disulphuret of Copper.	When we have yellow Sulphuret of Copper.	When we have Barnhardite.
1	0·678	0·268	0·445	0·384
2	1·346	0·536	0·889	0·768
3	2·019	0·804	1·334	1·151
4	2·692	1·072	1·772	1·535
5	3·365	1·340	2·223	1·919
6	4·038	1·608	2·668	2·301
7	4·711	1·876	3·012	2·687
8	5·384	2·144	3·557	3·071
9	6·057	2·412	4·001	3·454
10	6·729	2·677	4·446	3·838

The preceding table will show the necessary amount of pure hydrated nitrate of soda for the different sulphurets I have named, calculated for one equivalent of nitrate of soda to two of sulphur.

This table is based upon the facts already given, viz., that one hundred parts of sulphur require one hundred and fourteen parts of the pure hydrated salt for their oxidation, and that the various sulphurets contain the amount of sulphur already mentioned.

I have thought it unnecessary to go beyond ten per cent. in my table, because the subsequent portion would necessarily be a mere repetition, and too long for a paper of this kind. The table gives the amount to be used for pure sulphurets, but from it we can readily see the quantity required for mixed sulphurets for different per centages.

In calculating a table of the kind it was of course impossible for me to have reference to the commercial article and its casual impurities, nor could I pay attention to the variable admixture of atmospheric water. My calculations could only refer to the pure article when containing no other water than that of crystallization, as all other admixtures are so very variable. Practice alone can furnish a sure guide, and we may sometimes be obliged to double or even treble the above amount when the salt has been exposed and has absorbed much water, yet even then the quantity would be so small that no fears need be entertained as to the expense.

The nitrate of soda should be reduced to as fine a powder as possible—a very easy matter, and this should be done just before it is mixed with the ore, as otherwise the atmospheric water would soon cake it again. Of course it should be kept as little exposed as possible, and if such arrangements are at hand it would be well to place it, previous to use, in some easily-constructed drying oven. When both ore and nitrate of soda have been crushed and ground down, they should be intimately mixed in a dry state, so that every particle of sulphuret may be brought in contact with the salt. The mixed mass is then exposed to a very mild heat, which at its maximum should not exceed 500° Fahrenheit, or else ignition will take place if the ore contain a large per centage of sulphurets, although I have not been able to discover any serious evil from such ignition, as it is very slow, except that perhaps a larger amount of the salt will be required. The mass speedily assumes a dark color, and soon begins to cake, owing to the fact that nitrate of soda melts in its own water of crystallization at a very low temperature. If much of the salt be added, nitrous acid vapors will begin to rise; if it be used in the proportion of one to four of the sulphur, we shall soon have vapors of sulphurous acid. By collecting these in a chimney, and passing them into lead chambers, we may readily produce

good sulphuric acid in the ordinary way, which will have the great advantage over the common article of commerce in containing no arsenious acid. It is necessary to stir the mass occasionally. After a while the fumes will be no longer emitted, even when the mixture is stirred, and if it contained sulphuret of iron alone it will become red, otherwise it will be black. The process is now ended, and we remove it from the hearth. As hearth, a simple, slightly concave, and open vat or basin, wadded with clay, should be used, for it is exposed to a very moderate heat only, when we recollect that a red heat is as much as 1,077° Fahrenheit. If the hearth be of iron, ignition will more readily take place. Should this be preferred, a very hard cake will be the result, which, however, soon softens by absorbing atmospheric moisture. We may facilitate this softening process by sprinkling a little water over it. In either case the mass is submitted to a process of lixivation with cold water, and in this manner all the copper, as a soluble salt, is removed, together with all the soda, in shape of a sulphate, while all the gold remains with the desulphurized ore, and may be separated by amalgamation. The iron is left as peroxide only. The copper is then readily precipitated with metallic iron, so that this admirable process removes all the difficulty of separating the gold from the copper, which has induced many, who had rich copper ores, to abandon the gold entirely, and let it pass into the copper, while, by this simple plan, copper may be extracted from its poorest ores at no greater expense than if we had solid sulphuret of copper to treat.

The efficacy of Dr. Holland's process for the extraction, or rather exposure and reduction, of gold (for I firmly believe that the old theory of gold occurring in its native state only, is not based upon any thorough observation of facts), may be easily tested by trying the experiment upon tailings of the best amalgamators, such as Mr. Ball's. Dr. Holland and myself tried it upon some of these, from which the amalgamator had been able to extract no more gold, and by simple panning we obtained a very large quantity of the precious metal, I should think more than was originally obtained from it. Since then I have made experiments which establish it still more firmly, and these investigations will be continued.

As to the occurrence of nitrate of soda, I will say that Ure, in his dictionary of arts, manufactures, and mines, makes the following remarks with regard to the occurrence of nitrate of soda: "Nitrate of soda, cubical nitre, occurs under the nitre" (nitrate of potash, saltpetre) "upon the lands in Spain, India, Chili, and remarkably in Peru, in the districts of Atacama and Taracapa, where it forms a bed several feet thick. It appears in several places on the surface, and extends over a space of more than forty leagues (Resnfault says 100 square leagues), approaching

near to the frontiers of Chili. It is sometimes efflorescent, sometimes crystallized, but oftener confusedly mixed with clay and sand. This immensely valuable deposit is only three days' journey from the port of Conception, in Chili, and from Iquiqui, another harbor situated in the southern part of Peru." Besides this, I am informed of extensive beds in Arkansas and in the Western territories. It is certain that nature has abundantly provided us with this mineral, which soon we may expect to see so extensively employed. As yet the vast storehouse has scarcely been tapped, for no extensive application was previously known; but we may not be too boastful in supposing that we have now discovered the object of these great deposits, for wherever an obstacle has to be overcome in nature, we find the means for removing it at hand, if we only know how to make use of them.

It is impossible from present prices to judge what would be the probable cost of nitrate of soda, were a good market for its consumption opened; for at present its use is so confined that the importation of it is very small, and the price consequently high. If, however, an extensive application were to create a demand for it, vessels returning from California and the South Sea Islands would gladly load at Conception or Iquiqui, and thus immediately reduce the price. If I state that this substance is used as a manure in England especially, and also for the cheap manufacture of nitric acid and sulphuric acid, I believe I shall remove all fears with regard to its expensiveness.

There is no doubt left in my mind that Dr. Holland's process* will create a new era in the extraction of gold and other valuable metals, especially when united with the superb machine of Mr. Seymour for the concentration of ores, so that we may soon expect to see ores worked and *paying well*, which hitherto have never been looked upon as worthy of a moment's notice, and I may be excused for closing with the words of Byron, that

"This is the patent age of new invention."

* *Claim.*—That which I distinctly claim as my device and invention, legitimately, and for which I desire letters patent, is the desulphuration and oxidation of metalliferous sulphurets, for the specifical unoxidisable and more precious metals, by the application of the nitrate of soda and heat, silver and gold, also copper sulphate and oxide of zinc.

Application for patent, specification and fee, with specimens of sulphurets, were received and acknowledged on May 17th and 24th, 1854, by Commissioner of Patents.

July 11th, requested Hon. Charles Mason, Commissioner of Patents, to delay issue of letters patent until after the passage of the new Patent act, introduced into the United States Senate by Hon. Charles T. James.

HOMER HOLLAND.

WESTFIELD, *Hampden County, Mass., July 17th*, 1854.

COMMERCIAL ASPECT OF THE MINING INTEREST.

NEW YORK, *July 22d*, 1845.

Since our last, we have to record a more than usual dullness in mining stocks. In fact it may be said there has been almost nothing doing. This is owing to two causes—one is the want of confidence produced in the Southern mines, by the failure of the North Carolina Company; another cause has been the terrible blow given to confidence in every description of stock by the immense frauds of Robert Schuyler. All spirit of speculation has been destroyed for the present, and stocks left to find their own level, without any support from parties outside. This is apparent from the great amount of specie in the vaults of the banks and the large accumulations of deposit. It is a difficult matter to give quotations for mining stocks during the last month, as prices are in almost every instance nominal. *Pennsylvania Zinc* has fallen to the low point of $1\frac{7}{8}$ and little disposition to buy at that figure, although the Company are said to be doing an excellent business, and talk of a dividend be the close of the year. So much, however, has been said about dividends thy last year which has proved illusory, that people have no faith until they actually receive them. *M'Cullough* has fallen down to $\$2\frac{1}{4}$, at which point it is now stationary. They are also said to be doing well, but the delay has been so great that the patience of holders has become exhausted.

Gold Hill is the only stock upon the list in which large transactions have been made at great uniformity in prices. A dividend of two per cent. has been declared payable on the 1st of August. This of course gives a firm tone to the stock, and will bring in many purchasers, as at the present price it pays a very handsome return for the money.

In Lake Superior stocks there has been literally nothing doing, and we can therefore give no quotations, but judging from sales in other quarters, they appear to us to be unwarrantably depressed.

The *Phœnix Coal Company* are again sending coal to market. The amount despatched for the week ending 15th July, was 383 tons.

The *North Carolina Copper Company* have transferred their property to James Sloan, of Greensborough, North Carolina, in trust, to secure the debts due by the Company. The mine is said to be looking very well.

At the *Ray Mine*, belonging to the Mecklenburg Mining Company, the engine has reached the mine, and will soon be in operation. There is quite an amount of ore in sight, and it required only machinery to make the mine productive.

At the *Smart Mine*, of the Union Mining Company, the engine is put up, and they are about to commence sinking the shaft deeper on the argentiferous and auriferous galena vein.

At the *Rudisel Hill*, the engine is in operation, and one of Sandford's crushers and amalgamators is to be forwarded immediately.

The proprietor of the *Hip Mine*, Mr. Elms, of Charlotte, is about to forward a 10-horse engine to test that mine more thoroughly. It is a very promising mine.

The *Georgia Gold Company* are making extensive preparations at their mine for large operations.

Of the *Bowden Copper Mine*, located in Louisa county, Virginia, the Superintendent, Mr. Martin, writes under date of July 22d:—"Last night we came down on the back of the vein, in which we have taken some good pieces of gray and yellow sulphuret of copper. As soon as I can make another sink, I think I shall be able to show you a good lode or vein, such as will give entire satisfaction to all parties interested. I am delighted with the appearance of the lode and the splendid specimens we have taken from it.

"P. S.—Since writing the above, we have cut the lode and can see about three feet of the vein. The shaft is now about one hundred feet deep."

Fluctuations to July 22d, 1854, in the different Mining Stocks sold at the New York Stock Exchange and Mining Boards, showing their Highest and Lowest Points, and the Date, with the Market Value at this date, Gain or Loss for the month, and number of Shares sold.

Name of Stock.	Shares.	Par.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value July 22.	From June 20. Gain	From June 20. Loss	Shares Sold.
Aberdeen	—	—	—	—	—	—	—	—	—	—
Algomah Copper	20,000	25	2¾	29	—	—	1½	—	1½	100
Alleghany Coal	—	—	—	—	—	—	—	—	—	—
American White Zinc	—	—	¼	22	¼	24	¼	—	¼	550
Brookdale Lead	—	—	—	—	—	—	—	—	—	—
Buckingham Gold	100,000	5	—	—	—	—	—	—	—	—
Breckenridge Coal	—	—	100	22	—	—	100	—	—	25
Berdan's Crusher	—	—	6¾	22	3¾	24	6¾	3	—	3,225
Caledonia Coal	—	—	4¾	17	2½	20	4¾	¾	—	550
Calloway	—	—	—	—	—	—	—	—	—	—
Charlotte Copper	—	—	—	—	—	—	—	—	—	—
Chatham Cobalt	100,000	5	—	—	—	—	—	—	—	—
Conrad Hill Gold	—	—	—	—	—	—	—	—	—	—
Copper Falls Copper	10,000	—	—	—	—	—	—	—	—	—
Cumberland Coal	50,000	100	38	30	35	12	34	—	1	88,320
Dauphin and Susquehanna Coal	22,000	50	—	—	—	—	—	—	—	—
Dauphin and Susquehanna 7 per cent. Bonds	—	—	—	—	—	—	—	—	—	—
Dolly Hyde Copper	—	—	—	—	—	—	—	—	—	—
Duchess Silver	—	—	—	—	—	—	—	—	—	—
Douglas Houghton Copper	—	—	—	—	—	—	—	—	—	—
Flint Steel Copper	—	—	—	—	—	—	—	—	—	—
Fulton Copper	100,000	5	30½	29	—	—	¾	—	¼	1,000
Franklinite Scrip	—	—	—	—	—	—	—	—	—	—
Gardiner Crusher	—	—	—	—	—	—	—	—	—	—
Gardiner Gold	400,000	5	2¼	17	2¼	29	2¼	½	—	4,650
Georgia Gold	—	—	—	—	—	—	—	—	—	—
Gold Hill	200,000	5	3½	26	3	12	3½	—	¾	18,200
Hiwassee Copper	—	—	—	—	—	—	—	—	—	—
Isle Royale Copper	12,000	10	—	—	—	—	—	—	—	—
Lindsay Gold	100,000	10	—	—	—	—	—	—	—	—
McCullough Gold & Copper	200,000	5	4	24	2½	11	—	—	2½	6,400
Manitou Copper	20,000	5	—	—	—	—	—	—	—	—
Manassas Copper	—	—	30c.	26	—	—	30c.	—	45c.	200
Mineral Mining Co.	100,000	10	—	—	—	—	—	—	—	—
Middletown Silver Lead	—	—	—	—	—	—	—	—	—	—
Montgomery Zinc	80,000	12½	—	—	—	—	—	—	—	—
National Copper	10,000	25	—	—	—	—	—	—	—	—
Neuvitas Copper	—	—	—	—	—	—	—	—	—	—
New Creek Coal	200,000	10	—	—	—	—	—	—	—	—
New Jersey Zinc	96,000	12½	6¾	26	4½	21	4½	—	2½	7,800
North American Copper	10,000	—	—	—	—	—	—	—	—	—
North Carolina Copper	—	5	½	26	⅜	29	—	—	½	4,300
Ohio Land & Marble	30,000	100	—	—	—	—	—	—	—	—
Passaic Mining & Manuf. Co.	—	—	—	—	—	—	—	—	—	—
Pennsylvania Coal	50,000	50	104¾	5	103	19	103½	—	½	5,700
Pennsylvania & Lehigh Zinc	100,000	10	2¾	21	1⅞	17	1¾	—	¾	2,300
Phœnix Mining and Manufacturing Co	20,000	100	—	—	—	—	—	—	—	—
Phœnix Gold	100,000	3	½	27	—	—	¼	—	10c.	1,000
Potomac Copper	100,000	10	—	—	—	—	—	—	—	—
Potosi Lead	200,000	5	—	—	—	—	—	—	—	—
Randolph	—	—	—	—	—	—	—	—	—	—
Ripley Copper	40,000	12½	—	—	—	—	—	—	—	—
Rockland	—	—	—	—	—	—	—	—	—	—
Rocky Bar Gold	—	—	—	—	—	—	—	—	—	—
Rutherford Gold	—	—	—	—	—	—	—	—	—	—
Toltec Copper	20,000	25	—	—	—	—	—	—	—	—
Ulster Lead	—	5	½	27	—	—	½	—	—	400
Vandenberg Gold & Copper	100,000	—	—	—	—	—	—	—	—	—
Vermont Copper	—	—	—	—	—	—	—	—	—	—
Winthrop Copper	20,000	25	—	—	—	—	—	—	—	—
Wyckoff Gold	—	—	—	—	—	—	—	—	—	—

Note.—There has been no sale of the stocks of those Companies opposite to which the above table is blank. Our reports in a former Number furnish the amount of the last sales.

BOSTON MINING SHARE MARKET.

Boston, *July 20th*, 1854.

The mining share market presents few features of interest at the present time, and has settled down into a most uncomfortable state of dullness and stupidity. Such a condition of things was never known before, for it is not mining shares alone which have suffered, but stocks of all descriptions whatever have very materially depreciated within six months or a year, and more particularly of late, since the barefaced frauds which have been committed on the public both here and in New York.

The loss of confidence caused by over-issues and other rascalities, has so entirely pervaded the community, that investors are really afraid to buy anything, not knowing whether they obtain property for value received, or mere pieces of paper. It is this feeling of distrust that causes the great difficulty of negotiations, and not the want of money, for it is well known that more capital than usual is now lying idle, which would be employed at a fair rate of interest, could the lenders feel perfectly satisfied that the securities offered were *bona fide* what they represent. We do not anticipate any further over-issues of stock, but the immense injury inflicted by the errors already committed will not be effaced from the public mind for a long time to come.

The stock market is dull, dry, and spiritless, with transactions "lower and lower yet," as each day, week, and month progresses; and at present there is no hope of material reaction, except in some few stocks which have been unreasonably depressed from former prices. These, of course, are liable at any moment to advance quickly and gain a part of the previous reduction. Notwithstanding this general stagnation in the market for the different stocks, the *mines* never were in a more prosperous condition, and are steadily sending copper forward to the market in much larger quantities than any previous year. The results of the present year's work will be sufficient to satisfy the most skeptical as to the real value of the Lake Superior mines, and although the times are "deeply, darkly blue" for holders of mining stocks, there is good hope that everything will come out right to those who have the means and the will to see the end.

Pittsburg has fallen again about $15 per share, the price now being a shade under $140; this, however, is higher than the lowest figures some two months since. The Company have just declared a dividend of $8 per share, which is less than had generally been anticipated, and has probably caused, in a great measure, the large decline in the stock. It would not be at all surprising, however, if the present low rates should tempt purchasers who may have spare funds, and cause a slight upward movement again.

Copper Falls has declined to $45, which seems to be the basis, for the present at least, and the moment money becomes easy the price will advance again. The mine never looked better, and copper is rapidly coming forward. *Forest* has fallen in common with all others, but there is little stock offering,

the present position of the mine having a strong tendency to prevent the sale of shares, unless from parties who are forced to do so from lack of means. At last advices the new double engine had arrived, and the stamp would be in operation by August 1st, and possibly sooner. Mr. Livingston, the superintendent, is hard at work in pushing forward the shipments of copper, and the Company have a most faithful and energetic agent to look out for their best interests.

Norwich Copper has declined from $10 to $5 within a few months, owing to some financial embarrassments, and not on account of any failure at the mine, which never looked better. The Company have already assessed the amount limited by their charter, $5 per share, and now it is proposed to raise from $30,000 to $50,000 on their bonds, which amount it is anticipated will bring the mine to a paying point. The total paid in on assessments up to the present time is $100,000.

Minnesota is in demand at $170 bid, $175 asked without sales. Usually there is not much stock offered in the market, and the whole amount sold in 1853 was less than 200 shares. Few holders are willing to part with it at the current rates. *N. American* is dull and heavy at about $65, but the amount of stock offered in this market is seldom large, and the mine ranks A No. 1 among those of the non-dividend paying class.

Isle Royale has fallen to $14 asked, under the general pressure, but any demand for the stock would put up the price materially. It is very cheap at the present rates.

Toltec has declined to $5, with the $1 assessment, due July 1, paid. This is an unreasonably low figure for the stock, as the mine never was more prosperous, and there is every encouragement to the shareholders for holding on to their stock for future results.

The want of money for developing the mine has rendered large assessments necessary, and some parties have been forcing off their stock at best prices. If the Toltec does not prove a good mine we shall despair of general success at Lake Superior, though we do not wish to give the impression of having any doubt in the matter. Nearly all mining stocks are very low indeed, and the general details of the market are without interest. After we get through the "dog days" there will be some hope of a revival, and, in the mean time, all who can should keep quiet and not sell a share of stock unless actually forced so to do.

The *Iron* interests of Lake Superior are attracting considerable attention of late, and bid fair to become prominent in the future of that mineral region. A half dozen or more companies are in active operation, and although the quantity shipped the present season will be small, it is more in consequence of the great difficulty in getting forward the ore, than from any lack of it at the mines. The last winter was a hard one, with very bad roads, and in consequence of a plank or railroad being certain another year, but little ore was forced over the bad roads during the winter. When the ship canal at the *Saut* is finished, another season, then the facilities for forwarding iron will be greatly increased, and we may look for very large shipments in 1855.

The iron interests have suffered greater than any other for want of more direct communication with a market which has tended, more or less, to paralyze their energies for a time. After the present season, however, nearly, if not all the present drawbacks will be entirely removed.

Geologists have very generally decided against the existence of *coal* beds in the Lake Superior country, but we notice that the *Iroquois Coal Company* have recently commenced operations on their location about 25 miles above the *Saut*, and they have a practical miner at work with a small party sinking a shaft. We trust that their efforts will prove successful, as the discovery of coal there would be of immense benefit to the future welfare of that country. Although wood-land is at present abundant, the time is not very far distant when that source of supply will be in a great measure exhausted, and then, if not so much needed now, *coal* will be a most desirable article of fuel and always largely consumed.

BOSTON MINING SHARE LIST.

Fluctuations for June, 1854, in thirty-one different Mining Stocks, sold at the Boston Stock and Exchange Board, showing their Highest and Lowest Points, and the Date, with the Market Value at the close of the Month, Gain or Loss for the Month, and number of Shares sold in each.

Mining Stocks, Bostn.	Nominal Capital.	Shares.	Par.	Paid in July '50.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value June 30.	From May 31. Gain	From May 31. Loss	Shares sold in June.	Value July 30.
Adventure, *Copper.*	$250,000	10,000	25	$11.00	—	—	—	—	2	—	—	No sale.	1¼
Albion.....	500,000	20,000	25	1.87½	2¾	17	2¼	17	2¼	—	—	350	1¼
Bay State	500,000	20,000	25	‡2.00	—	—	—	—	—	—	—	No sale.	—
Bohemian	250,000	15,666	15	4.94	2½	24	2¼	24	2¼	—	—	50	†2
Boston	500,000	20,000	25	‡2.00	—	—	—	—	—	—	—	No sale.	—
Copper Falls.....	300,000	10,000	30	18.00	62	2	55¼	30	56	—	5	347	45
Dana.....	500,000	20,000	25	1.62½	¾	20	¾	20	¾	—	¼	50	¾
Forest	200,000	10,000	20	15.00	11½	6	10½	20	10¾	—	¼	292	9¾
Fulton.....	500,000	100,000	5	‡2.00	¾	27	¾	27	¾	0	—	1,050	¾
Glen.....	500,000	20,000	25	‡2.00	—	—	—	—	1½	—	¼	No sale.	1¼
Isle Royale.....	120,000	12,000	10	9.00	18¼	7	16¼	30	16½	—	2¼	893	14
Malone, *Sandstone.*	400,000	40,000	10	3.12½	50	23	45	6	50	—	18¾	200	45
Manassas, *Mining.*	1,000,000	100,000	10	‡2.00	—	—	—	—	—	—	—	No sale.	—
Manton, *Copper.*	100,000	10,000	5	1.25	—	—	—	—	¼	—	¼	No sale.	¼
Minnesota	300,000	8,000	100	92.00	180	20	180	20	190	10	8	3	175
National.....	250,000	10,000	25	8.00	—	—	—	—	20	—	—	No sale.	20
Native.....	250,000	10,000	25	4.75	—	—	—	—	—	—	—	No sale.	†2
North American....	300,000	10,000	30	21.50	—	—	—	—	14	—	—	No sale.	65
Norwich.....	100,000	20,000	5	‡5.00	—	—	—	—	5	—	4	No sale.	5¼
North Western.....	300,000	9,000	33⅓	14.67	24½	20	24	30	24	2	—	145	24
Phenix.....	300,000	10,000	30	7.00	7	10	6	17	6	—	1	167	†7
Pittsburg, (*Clif*)...	.....	6,000	—	18.50	138	6	145	29	145	0	8½	14	140
Ridge	.....	10,000	—	6.50	—	—	—	—	5¼	—	—	No sale.	5¼
Ripley.....	500,000	40,000	12½	2.00	2	9	1¼	28	1¾	0	—	820	*1¾
Shawmut.....	500,000	20,000	25	3.00	1½	17	1½	17	1	—	—	50	¾
Star.....	500,000	20,000	25	8.50	—	—	—	—	5¼	—	—	No sale.	5¼
Summit	500,000	40,000	12½	‡5.00	—	—	—	—	6	0	0	No sale.	6
Tolles.....	500,000	20,000	25	6.00	8½	1	5	26	5¾	—	2¼	2,273	†4¾
Winthrop.	500,000	20,000	25	1.25	2¼	8	1¾	20	1¾	—	—	995	†1
Webster	200,000	40,000	5	‡2.00	1	13	1	13	1	—	—	100	¾
W. Castleton, *Slate.*	1,000,000	50,000	20	‡6.00	—	—	—	—	2¼	—	—	No sale.	2

† Assessment paid.

‡ These are fully paid stock, not assessable.

* Ex-dividend of one share new stock for every four shares old stock, on payment, July 25th, of 50 cents on each share.

JOURNAL OF GOLD MINING OPERATIONS.

The product of gold throughout the world presents no indications of an immediate decline. The only variations observable are in the markets to which the metal is sent. This is particularly the case with the California gold, much of which is now retained at home.

CALIFORNIA GOLD FIELDS.

The shipments of gold from San Francisco to New York during the first months of this year show a decline as compared with the previous year. This, however, is ascribed to the fact that more gold is required for the trade and commerce of California. The following statement shows the amount manifested by the steamers to New York as compared with the same period last year. This is independent of the export to other parts of the world:—

	1853.	1854.
January 15th,	$1,744,399	$1,729,582
February 1st,	2,430,000	1,755,488
" 15th,	2,890,558	2,081,729
March 1st,	2,066,338	1,540,647
" 15th,	2,419,400	1,816,794
April 1st,	2,234,308	2,206,789
" 15th,	2,596,560	2,312,424
May 1st,	2,130,738	2,149,681
" 15th,	2,511,986	2,347,444
June 1st,	2,604,583	2,685,615
Total,	$23,628,870	$20,626,073
Difference in favor of 1853,		$3,002,797

It will thus be perceived that the exports of treasure for the present year, up to the 1st June, fall short of those during a corresponding period of 1853, more than three millions of dollars.

THE PRINCIPAL GOLD MINES OF CALIFORNIA.

The excellent report of Professor Trask contains many details relative to the principal gold mines in California, at which gold is obtained by extracting it from quartz. It presents an accurate view of the present condition of this interesting branch of mining:—

La Fayette and Helvetia Mine.—This Company is located at Grass Valley, Nevada county, and the sketch of the workings of their mine is taken from the La Fayette Hill vein only about two miles south-west of the town. The length of the vein at the above hill is eleven hundred feet; it has a curvilinear course, varying from north-east to south-west; its mean, however, when marked on a right line, is north, ten degrees east. The dip of the vein is forty-one degrees east, having a power of three feet at the depth of thirty-four feet; at this point the ore was of a poorer quality than at any other point. The depth of the present working is about fifty-five feet, and here the vein increases in power and value, being equal to three feet eight inches, and yielding in a large amount of ore, forty dollars per ton. The vein, when discovered, was covered with yellow brown alluvium for five feet, and passed through this and decomposed granite of a purple color fifteen feet, when it entered a mass of decomposed and fragmentary greenstone of five

feet depth, thence into compact rock of the same character, and continued to the depth of fifty-five feet.

Adit level is 1,100 feet in length, exclusive of tramroad for conveying ore and attle from the mine; it extends through the whole length of their claim. At their present depth all the ore is obtained by blasting, which adds much to the expense of the mine. The cost of obtaining ore from this mine is from seven to eight dollars per ton at present rates of labor. The Company have about 900 feet of vein in Gold Hill, which requires no blasting, and is obtained at the mill for five dollars per ton.

The La Fayette Hill vein was much decomposed for the depth of thirty feet, and contained a large quantity of peroxide iron and free gold; after passing into the compact greenstone the vein becomes quite firm, and highly charged with pyrites investing gold; the crystals were white and well terminated, generally perfect in form. In some parts of the mine, galena is met with and gold embedded in it; an examination of this latter mineral has not been made for silver, but from its appearance it is quite probable that it contains this metal. The matrix of the ore is a bluish white and translucent, in pieces of one inch in thickness; the blue tint of the vein in the vicinity of the shafts is due in a great measure to finely divided particles of lead.

The capital of this Company is about three hundred thousand dollars, and their receipts in four months has been as high as ninety-eight thousand dollars, but their average is near ten thousand dollars per month; the mine has yielded with great uniformity since the commencement of operations, and bids fair for future success.

This mine has two batteries, and when in full operation is capable of reducing forty tons of ore per day; but one battery is run at a time as the amalgamating apparatus is not of sufficient capacity at present to dispose of that amount of ore judiciously. The amalgamating instruments consist of Cram's cylinder and Berdan's amalgamator; in the latter about fifteen per cent. of the gross amount is saved after it has passed through the other instruments; this arises from the fact that Berdan's instruments possess a levigating power from revolving balls in the instrument which give a new surface to the material passing under them.

Gold Hill Mine.—This mine is located in the town of Grass Valley on the first hill to the west of the village. The mine was first opened in 1851, and worked to a considerable extent and profit; subsequently it passed to the hands of the Agua Frio Company under the superintendence of their agent, Mr. Attwood, in whose possession it now remains; after an examination of the mine the old method of working was given up, and a new system of operations entered upon in order to tap the vein at the lowest possible point and at the same time afford easy transit to the reduction works and drainage to the mine. With this view an adit was commenced about fifteen feet above the level of the creek which flows in front of the town, and carried west through the base of the hill for a distance of seven hundred feet, cutting through alluvium and decomposed granite most of the way; at the west end of the adit which cuts the vein nearly at right angles, the shaft marked A in the longitudinal section was intersected at a depth of ninety feet below the surface; from near the ninety-feet shaft a level has been driven to the north on the strike of the vein about seventy feet, marked D, also two other levels east of it, E, F, which intersect the north cross-cut D of the ground plan; a winze has been sunk below the water-level sixteen feet, marked H, of the longitudinal section; this disposition in the working of the mine affords many advantages in the extraction of the ore and attle and easy communication with all parts of the mine and surface, and the intersection of the shaft A produces ample ventilation. The vein intersects the greenstone at the bottom of the air-shaft, and as in the case of the Lafayette has cut completely through it, increasing in power as it enters this rock. About one thousand tons of ore was in the yard at the time I visited the mine ready to pass through the reduction

works. From the end of the long adit a tram-road four hundred feet in length passes to the mill on which by *mule power*, the ore is conveyed from the farthest part of the mine. The ground plan exhibits the cross-cuts and levels and their connection with the mill.

The strike of the vein is north and south, dipping east at an angle of twenty-four degrees, with a vein whose power at ninety feet was nearly three feet; the transverse section is shown, the air-shaft entering the greenstone and intersecting the vein, with the increase in power of the vein from the surface to the lowest point worked. The ores in the greenstone differ in no particular from those of the Lafayette, with the exception that none of the plumbic sulphuret was observed at this mine though the vein has much the same blue tint. The reduction works of this Company were not completed in November, and no opportunity was afforded to witness their process at that time; it was expected that their machinery would be capable of reducing over one hundred tons of ore per day, which from its appearance would not be a large estimate. It is probably the most powerful machinery in this country, and will compare with any in Europe.

The operations of this mine are looked for with considerable interest at home and abroad, as their capacities for reduction are much more extensive than any hitherto put up in this country.

Osborn Hill Mine.—This mine is located two miles east of Grass Valley. It has been opened on the course of the vein four hundred and fifty feet and from sixty-five to seventy feet in depth. Vein strikes north and south, dipping east at an angle of forty degrees; the transverse section shows a depth of sixty-five feet; the shaft was carried through twelve feet of alluvium, seven of clay-slate, seventeen of a much broken and decomposed greenstone, and fifteen feet of compact rock of the same character; total depth, including winze I, is nearly seventy feet. The vein at this mine has dislocated all the rocks above it, and possesses that half-stratified appearance as in the Lafayette, arising from fracture by the intrusive vein. The power of the vein is about three feet at the depth of sixty-five feet. In the longitudinal section, the levels which have been driven are given to scale and their different lengths are found by reference to the sketch. This mine has been one of the most flourishing and profitable of the State, and has been conducted with much prudence and economy.

Wyoming Mine.—This mine is situated on the north bank of Deer Creek, about two miles below the town of Nevada; its altitude above the creek is two hundred and forty feet, and the higher parts of the outcrop on the line of the vein will reach nearly or quite three hundred feet above the same point. An adit was driven about two hundred feet through clay slate, which intersected the vein at this point, at an angle of about twenty-seven degrees. From this, two levels have been driven on the vein, of one hundred and twenty and fifty feet each, and a winze of twenty-five. The vein dips east with an angle of forty-five degrees, having a strike north and south, with a power of three feet. Fifty feet below the upper adit, another was commenced and carried to a hundred and twenty-five feet, intending to intersect the vein at one hundred feet below the surface of the shaft F; at seventy-six feet the greenstone was met, and the adit carried fifty feet into it. At the junction of the slates and trap, the former are much changed, evidently from the effects of heat, while at the junction of the slates and vein, above this, they have again suffered from the intrusion of the latter.

On the south side of the hill, the vein crops cut through the trap two hundred feet below the summit, with an increased power, leaving no room for doubt of the permanency of its character. In this mine one of the recent veins has cut through from the Bunker Hill mine, east of this, which produced a valuable nest of ore; the dip of the principal Wyoming vein, if it holds its present inclination, must cut the older lodes at the depth of four or five hun-

dred feet, and its situation is such that ample drainage and ventilation can be obtained.

Gold Tunnel Mine.—The mine bearing this name is located half a mile west of the town of Nevada, on Deer Creek, and has been worked successfully since its discovery in 1850 or 1851. It was originally a placer claim, and was found while working the banks of the creek for placer gold. Soon after its discovery, an engine was erected upon the ground and the vein opened; it was commenced by driving an adit level on the vein, which was subsequently abandoned, and a new level commenced at the point at which the present reduction works are situated.

The length of the present level is three hundred and seventy-five feet, and has an inclination of ten degrees from the horizontal line; three winzes have been drove on the lower side of the adit [L. F. H.] which are respectively thirty, twenty, and twelve feet, with a level of twenty-five feet between the winzes F. and H. On the opposite side two cements of fifty feet each, and a gallery connecting both, of one hundred and twenty-five feet, with a corresponding one connecting the winzes on the lower side. All the ore included within the dash lines has been stoped out. This vein is situated in granite, and thus far has been loose and incoherent; this is attributable to the large amount of pyrites contained in the vein, as is shown at any point where the quartz retains any solidity; the gold is in a free state in the gossan, of which there are large quantities throughout the mine; the operators on this vein have been eminently successful, and their mine bids fair to continue valuable. The strike of their vein, north ten degrees east, dipping east ten degrees south, at an angle of thirty-eight degrees.

Illinois Mine.—The Illinois mine is situated directly opposite the Gold Tunnel on the south bank of Deer Creek, and is a continuation of the same vein; it has all the characteristics of the former throughout. The length of their upper gallery is four hundred and fifty feet, and that of the lower, two hundred and fifty; two cross-cuts have been driven which connect the galleries at C D, each fifty feet in length.

Jones and Davis Mine, Herbertville, Calaveras County.—The mine of this Company is located on the east side of a small tributary running into Amidor Creek, the latter passes through the town of Amidor one mile north of this mine; the top of the whim-shaft, C, is one hundred and forty-five feet above the level of the creek, and ninety feet below the outcrop of the vein on which the shaft, C, has been sunk; at shaft 4 the vein is three hundred and fifty feet above the Amidor, and increases in altitude for half a mile, until it arrives at the height of four hundred feet above the town. The Company have sunk two shafts of ninety feet on the vein, and drove two galleries, the upper one, A, being two hundred and eighty feet, the lower, B, one hundred and fifty feet, and are driving in the course of the dotted lines, to run a third gallery at the depth of fifty feet below the point B. Figures 1, 2, 3, are stopes from which they are now obtaining their ore, being conveyed along the lower level to the whim-shaft, and thence elevated to the surface; from thence it is conveyed on a tram-road 600 feet to the reduction works at its terminus.

The design for future operations is to cut an adit a short distance north of the mill, and intersect the vein at a point which will give a depth of three hundred feet from its highest point to a level with the end of their present tram-road, and then stope down from this point, which will not only furnish an abundance of ore, if the vein retains its present power, but materially lessen the expense of its extraction. This will be accomplished in a distance of three hundred yards, and probably less. This mine is very systematically arranged for the comfort of the miner, and obtaining all the ores easily, and reflects much credit on its projectors; the sketch of the mine, drawn to scale on the spot, will fully elucidate itself; its convenience of arrangement, considering its local position, will be found equal to all its necessary requirements.

The vein is invested in chlorite and talcose rocks, throughout its whole extent, being nearly three miles in length. On the eastern side of the vein a graphic slate occurs, having a thickness of one or two feet; outside of this a bed of chlorite, from five to ten feet, much discolored by graphite, at times perfectly black, and staining the hand easily. On the west side, a greenish chlorite occurs, next the vein, highly pyritiferous and often containing considerable gold; the power of the vein at ninety feet depth is six feet, and has steadily increased from the surface down; its strike is north-west by west, with a corresponding dip east and south, of fifty-five degrees. The color of the vein is bluish white, with black seams of graphite, giving a riband-like appearance in the mass; it is highly pyritiferous, and when properly roasted, crumbles easily; some parts of the vein contain an arsenical pyrites, which has an injurious effect in the reducing process, by preventing perfect amalgamation; this is caused by roasting the ores in contact with charcoal, which should not be practised in these varieties of ore.

Spring Hill Mine.—This mine is located on Amadore Creek, at the east end of the town, and one mile north of the preceding mine. The Company commenced operations on this sett in 1851, and have continued uninterrupted since that time; it is located on the same vein as the former, and crops out to the height of five hundred and thirty feet on the highest point of the hill between Jones, Davis & Co.

Two inclined shafts have been sunk on the vein to about seventy-five feet below the bed of the creek, at which point the sett has a power of six feet; in its general character it differs in no wise from the mine one mile south, except in the disposition of investing rocks. At Spring Hill the graphic slates which form the gangue are found on the west side of the vein, in place of the east, as at Davis' mine. This was evidently caused by an unequal displacement at the period of intrusion of the dike, resulting from the transverse fracture forming the cross course on which Johnson's mine is situated; the resistance being less in that direction at the time of fracture in the incumbent rocks. This cross fracture had the effect also to throw the intrusive mass from a right line at the time it broke through, for the entire length of the dike, giving it at first view the appearance rather of two setts in place of one which they in reality are. There are many similar features attending the veins of this country, which has created no little confusion in regard to their true position; and of themselves though they may appear insignificant, yet with the miner they involve questions of high importance, and exert an influence either prejudicial or favorable upon his operations, as their position may be clearly or distinctly known.

The study of our system of metallic veins and its correct development, involves some of the most important interests of the State; a correct knowledge of their position is much desired, but as the limits of this report will not admit that examination which they require, further allusion to the subject will be omitted.

All the vein between shafts and to the point E, has been stoped out with the exception of a small body of vein to support the walls of the mine and attle F F. The mine, from its proximity to the creek, has considerable water, but is kept free by one of Farnham's double-action pumps placed at the shaft B, while the shaft A is used for bringing the ore to the surface.

Amadore Company Mine.—This is situated on the opposite side of the creek from the Spring Hill mine, and on the same sett. Their operations have been conducted below the bed of the creek, to the depth of nearly one hundred feet. Shaft D is the whim-shaft, ninety-seven feet, and is to the depth of one hundred feet, at the bottom of which a thirty-seven foot horse has been struck; all the ore from the lower level A C has been stoped out, the points I supporting the attle. Reference to the sketch will present its position at the date of visiting it.

The strike of the vein in both the latter, is north by west, dipping east sixty-five degrees.

Ranchoree Mine, is located one mile north of the preceding, and on the ridge dividing the Amadore and Ranchoree Creeks; their reduction works are about half a mile west of the town of Ranchoree.

The upper portion of their vein is situated four hundred and twenty feet above the creek; on the vein are three shafts of about seventy feet, and two levels of one hundred and ten and seventy-five feet respectively; they are now driving on the level I, to obtain drainage and easy transit for their ores to the mill; the plan of operations will be seen on the sketch marked by the dash lines. The vein at this lower level gives a good ore, and has the same investing rocks as at the upper levels. The vein strikes north twenty-five degrees west, dipping east, with a power of four feet. The investing rocks are talcose slates.

Keystone Mine.—This mine is situated on the arroya leading into the Amadore, one mile below Jones & Davis' mine; it appears to be a parallel vein, half a mile west of the line uniting the latter and the Spring Hill mine; the ores partake of all the general characters of the other two mines, and it is situated twenty-five feet above the level of the creek. The sett of Jones, Davis & Co., and the Spring Hill are in the high hill east of the workings figured in the sketch for the Keystone mine.

This vein strikes north ten degrees west, dipping forty degrees east, with a power of five feet; the investing rocks are the graphic slate and chlorites, as found in all the others in this neighborhood.

Eureka Mine, Sutter, Calaveras County.—This mine is located a short distance south of the town of Sutter. The Company have one shaft, A, which is used for the whim by which the ore is at present taken from the mine: a cross-cut, seen at D, in the ground plan, was carried east one hundred and forty feet, intersecting the level, D, and main shaft; from this the gallery, B, was carried south one hundred and thirty-five feet, and subsequently the lower level, C, was driven each way a distance of two hundred and thirty feet.

The mine is in active operation, and they are now driving an adit on the east side of the hill, which will intersect their vein at an angle of sixty-five degrees to its line of strike; this will be four hundred feet in length, and will afford easy and rapid communication with the reduction works. At the end of the adit a tram-road is constructed 2,800 feet, which connects with the mill; the gallery, B 2, will be connected with the adit in the dotted line, F, of the ground plan.

The vein of this Company is in chlorite, and has a strike north and south, dipping east fifty-five degrees, with a power of five feet; the vein has a riband-like appearance in masses, from small seams of graphic slate running through it. The vein contains some arsenical ores, which are highly auriferous.

LIST OF GOLD MINES AT PRESENT IN OPERATION IN CALIFORNIA, WITH LOCATION, POWER EMPLOYED, ETC.

COUNTY.	TOWNS, ETC.	NAME OF MINE.	LOCALITY.	POWER.
Nevada.	Nevada and vicinity.	Gold Tunnel.	Deer Creek.	Steam.
"	" "	Golden Gate.	Little Deer Creek.	"
"	" "	Nevada.	Deer Creek.	Water.
"	" "	Wyoming.	"	"
"	" "	Wisconsin.	East of town.	"
"	" "	Illinois.	Deer Creek.	"
"	" "	El Dorado.	"	"
"	Grass Valley.	Gold Hill.	West of town.	Steam.
"	"	Crossett and Collins.	Osborn Hill.	"
"	"	Empire.	Ophir Hill.	"

TABLE CONTINUED.

COUNTY.	TOWNS, ETC.	NAME OF MINE.	LOCALITY.	POWER.
Nevada.	Grass Valley.	French.	Union Hill.	Steam.
"	"	Lafayette & Helvetia.	Lafayette Hill.	"
Butte.	Jamison Creek.	Washington.	Jamison.	"
"	"	Eureka.	"	Water.
Sierra.	Downieville.	Ariel.	South Fork.	"
Yuba.	Brown's Valley.	Huntley's.	"	Steam.
Shasta.	"	Kelby's.	"	"
"	Mt. Washington.	Mt. Washington.	"	"
Siskiyou.	Scott's Valley.	Stents.	Scott River.	Steam.
"	"	Shackleford's.	Scott Valley.	
"	"	Moffat's	"	Water.
"	"	Martin's.	Humbug Creek.	"
Klamath.	Sealey's Flat.	McDermott's.	"	
El Dorado.	Union Town.	Union.	Marthenas Creek.	Steam.
"	Quartzville.	Thomas's.	Consumnes River.	Water.
Calaveras.	Ranchoree.	Ranchoree.	Creek.	"
"	Amidor.	Amidor.	Town and Creek.	Steam.
"	Spring Hill.	"	" "	"
"	Amidor.	Keystone.	Tributary Creek.	"
"	Herbertville.	Jones & Davis's.	"	"
"	"	Lea & Johnson.	"	"
"	Mokelumne Ridge.	Woodhouse.	"	"
"	"	Phœnix.	"	"
"	"	"	"	"
"	Sutter.	Eureka.	Sutter Creek.	Water.
"	"	Amidor, No. 2.	"	Steam.
"	Jackson.	Oneida.	"	"
Tuolumne.	Maxwell Creek.	Harris's.	Creek.	"
"	Coulterville.	Maxwell Creek Co.	"	"
"	Merced River.	Marble Springs.	North Fork.	"
Mariposa.	Mt. Ophir.	Noveau Monde.	Mt. Ophir.	"
"	Quartsburg.	Washington & Georg.	Quartsburg.	"

From this it will be seen that there are thirty-nine mines in successful operation in this State at the present date, twenty-eight of which I have personally visited this season, and my excuse for not visiting the balance, was the lateness of the season and distances, with the time necessarily required to compile this report, being now delayed much beyond the time when it should have appeared.

ALTITUDES TAKEN BY ANEROID BAROMETER NO. 10,811, WITH THE COUNTIES AND LOCALITIES IN WHICH THEY WERE TAKEN.

COUNTY.	LOCALITY.	POSITION.	ALTITUDE ABOVE THE SEA.
Santa Clara.	San José.	Mansion House.	150 feet.
"	Almaden.	Hotel.	480
"	Mine.		1345
"	Houck's Ranch.	Santa Clara Valley.	190
"	Gilroy's.	"	155
"	Mission Peak.		2025
Monterey.	Mission San Juan.		210
"	Ranch Tres Pinos.	Cañada San Benito.	220
"	Pass Santa Anna.	Top of hill.	615
"	Cañada San Juan.	Four miles south of the above	300
"	Cañada Las Muertos.	Entrance.	280
"	Sierra Gibilan.	Summit.	2780
"	Chupedero.	"	2368
"	Chelone.	"	2010
"	Soledad Mission.		312
"	—	Hill on road from San Juan to Watsonville.	340
San Luis Obispo.	High Ridge.	South Nacismiento.	2460

TABLE CONTINUED.

COUNTY.	LOCALITY.	POSITION.	ALTITUDE ABOVE THE SEA.
Alameda.	Mission San José.	Portico.	295
"	Sunols Hill.	Entrance to Valley.	505
"	" Valley.		285
"	Seven Mile House.	Sunol Valley.	240
"	Livermore Ranch.	Livermore Valley.	420
"	—	Hill in Pass nine miles from Ranch.	865
"	—	Cañada half mile north of hill.	584
"	Stone House.	Bottom of hill, one mile.	680
San Joaquin.	Elk Horn.	Mouth of Livermore Pass.	220
"	Suddenfield's Ranch.	San Joaquin Valley.	80
Nevada.	Nevada City.	Adams' Office.	1810
"	*Grass Valley.	"	1950
Placer.	Auburn.		1060
"	—	Half-way House to Sacramento.	670
El Dorado.	Aurum City.		1200
"	Mud Springs.		1450
Sacramento.	North Fork House.		170
"	Sacramento City.	Levee.	80
Yuba.	Marysville.		78
"	Johnson's Ranch.	Bear River.	1120

Altitudes were taken in the counties of Butte, Sierra, and upper part of Yuba with another instrument, but as it was found not to correspond with the points of departure on my return, the observations were presumed to be incorrect, and therefore are not given in this table. Some of the localities in this table have been levelled and their height accurately known, and as the barometric measurements have been found to correspond, they are probably close approximations.

WATER COMPANIES.

The following are reported as accurate statements of the profits of some of the water companies:—

Columbian Ditch Company, 4 per cent. per month.
Ditch on Rich Gulch, 12 per cent.
Ditch on the head of Rich Gulch, 6 per cent.
Two ditches in Butte city, 5 per cent.
A small ditch at Jackson, costing $1700, pays $100 per day.
The Sutter Canal Company pays largely.
Willow Spring Ditch pays largely.
Deer Creek and Prairie City, 3 per cent. per month.
Coon Hollow Ditch, 10 per cent.
Two ditches at Coloma pay 5 per cent.
Rock Creek Ditch, near Georgetown, pays 5 per cent.
Natoma Water Works, (Mormon Island,) 12 per cent. per month.
Auburn and Bear River, 20 per cent. per annum.
The South Fork (Yuba) Canal, cost between $600,000 and $700,000, and yields a profit of $2,500 per week.
Gold Hill Ditch, 42 per cent. per month.
The ditches in Nevada county pay from 6 to 50 per cent. per month.

Ione Valley.—Between the hill and this place the country bears evidence

* A difference of fifty feet by observation of Mr. Attwood with mercurial barometer, taken three quarters of a mile south: difference probably in elevation of both places.

of great works. Masses of water rush roaring down every ravine in laboring dress. Canals, the circulating medium of plenty, intersect your path on all sides, and are beginning to form a famous network upon the bosom of mother earth. Everywhere may be heard the blithe sounds of honest industry, the busy stroke of the pick and hammer. General prosperity prevails. Even the loafer, the lowest order of the genus man, does not ask you for two bits if he sees you smile in this diggings.

Westward of Ione are good fine-gold diggings in the foot hills, now unworkable for the want of water. A ditch, Sutter's Creek, (now being surveyed) will soon remedy the deficiency. To complete this work will require an aqueduct nearly two miles long, and in some places nearly one hundred feet high. The mode of working the diggings before mentioned, is to run a plough through the surface, and to wash in the sluice with the aid of quicksilver. By this method two men may make as high as $40 per day, with from one half to three cent dirt.

The new diggings are situated some 350 miles from Stockton, high up in the elevated region in the direction of Kern's Pass. The traveller follows the southern trail until he strikes Posey, beyond White river; thence he proceeds along an Indian trail (by which Fremont came into California on his last trip) in a south-easterly direction. Kern river, where the gold has been struck, is a stream about as large as the Moquelumne. The flats forming its banks are represented to prospect richly, and of the whole adjacent mining country the same may be said. For twenty miles from where the miner strikes the diggings the road is very rugged; so much so that it is necessary to use pack mules in the transportation of provisions, etc. Wagons are of no service.

Carson Valley.—The *Mountain Democrat* has the following:—We learned that rich diggings had been struck near this city, at Coon Hollow. This point has for years been rich, and no one, to our knowledge, has been a loser by remaining there. The rich deposits abstracted from the centre of giant hills, is a sufficient guarantee that those diggings are unequalled.

Indeed, the method now in general use, of hydraulic power, where they wash tons and tons of earth before they strike the bed-rock, is another important feature in successful mining. The new discovery is near the centre of Coon Hollow, at a point which has hitherto remained undisturbed. Thirty dollars to the pan was taken, and there is every reason to believe that the balance of the divide contains large quantities of gold. Such, at least, is the prevailing opinion among old miners. And then, too, we have acres added to the best mining region in the State. The ditches furnish an abundance of water at low rates, and we call the attention of the people to the fact that no point in this country presents as many inducements for mining as the old and renowned diggings of Coon Hollow.

We take the following items from the *Grass Valley Telegraph*:—

At the Eureka tunnel, (not a rifle shot from our office), the boys have indeed struck a good thing. On Saturday we were present at the washing out, and saw twenty-nine ounces and twelve dollars as the result of a day's work. On Monday and Tuesday the yield was very similar, and we feel convinced that they have a long-continued richness before them. In this Company there are eight men.

At Osborn Hill, [illegible]srs. Crossett and Company have struck a quartz lead, concerning which the most exaggerated accounts are given. We are, however, reliably told that the rock, in the aggregate, is paying $100 per ton.

From Houston Hill we have gathered specimens during the past week, which we consider quite an ornament to our sanctum. While there, we went down into the shaft, and could plainly see the gold glittering among the rocks. The dirt also has every appearance of being vastly rich. Taking the rock from this lead, as it comes out, it will yield from $70 to $75 per ton.

The Drakesville Company took out $1,897 during the past week.

AUSTRALIAN GOLD FIELDS.

We continue the report of the weekly receipts from the Australian gold fields, by escorts, from the last statement on page 657, Vol. II.; also the results of a further investigation of the total production of Victoria, by Mr. E. Khull, and which is considered by competent authorities to be as nearly accurate as the nature of the subject will admit. The first great gold field, that of Ballarat, was discovered in August, 1851, and the produce of that year was as follows:—

	Ounces.	
1851—Ascertained,	145,146	
Estimated,	200,000	345,146
1852—Ascertained,	3,501,042	
Estimated,	762,000	4,263,042
1853—Ascertained,	2,472,713	
Estimated,	617,629	3,090,342
Total on 31st December, 1853,		7,698,530

Which at the present value, 3*l.* 19*s.* 6*d.* per ounce, amounts to 30,501,681*l.* 10*s.* although the colonists have not reaped the advantage of such a value to any great extent, as the price has been lower, and at one time did not amount to more than 3*l.* 5*s.* per ounce. The quantities brought to Melbourne and Geelong, by the armed Government escorts, do not accurately indicate the amount produced, as large quantities have been taken to Adelaide and Sydney by escort and private hands. Recently the Sydney and Adelaide escorts have been discontinued, and the Victoria escorts will now more nearly show the produce; but it is notorious that still very large quantities are brought into Melbourne by diggers and storekeepers, and the quantities thus brought may reasonably be expected to have increased since the improvement in the police has rendered the roads much more safe, even to unarmed and solitary travellers. The quantities brought by escort from the various gold fields, since the date of our last summary, is as follows:—

Week ending—	Mount Alexander, Bendigo, Tarrengower. Ounces.	Ballarat. Ounces.	Ovens. Ounces.	M'Ivor and Goulburn. Ounces.
January 28,	19,837	10,646	—	448
February 4,	16,615	10,942	4710	635
" 11,	17,880	9,609	—	564
" 18,	18,570	12,402	9446	282
" 25,	18,669	15,686	—	569
March 4,	16,976	16,774	7870	—
" 11,	18,670	13,480	—	—
" 18,	17,346	18,770	4999	439

During the week ending March 23d, which is incomplete, the following amounts have been received:—From Ballarat, 19,859 ounces, 10 dwts.; from Mount Alexander, 18,244 ounces, 4 dwts.

The yield, at later dates, of the old gold fields continues remarkably steady, although a comparison of quantities for the first four months of the years 1853 and 1854, respectively, continues to show a falling off in our receipts per government escorts, to the extent of about 3,530 ounces per week. These escort returns, however, are no infallible guides to the actual yield, especially at the present time, when branch banks and brokers at the principal gold fields are paying the diggers within sixpence per ounce of the Melbourne prices. The broker's price to diggers at this date, is £3 19*s.* per ounce. The shipments for the six weeks under notice, have been exclusively to London and Liverpool, and have comprised 141,742 ounces. The entire shipments for the year up to this date have been 713,230 ounces, being 47,415 ounces less than the shipments in the corresponding four months of 1853.

PROFITS OF THE VICTORIA DIGGINGS.

Until Victoria is really settled and cultivated, instead of being merely dug up in particular spots in the search for gold, the gold fields constitute, as it were, the heart of the colony, and it is only while the heart beats well that the life stream of wealth can be in a healthy circulation throughout all the veins and arteries of our trade. To say, then, that Victoria is prosperous, in the ordinary and commercial senso of the term, is equivalent to saying that the gold fields are doing well. It is more difficult, indeed, than it once was to estimate the actual yield, because the far greater safety with which the roads may now be travelled (thanks in a great measure to the anti-convict act) induces numbers of diggers to bring their own gold into town, and hence the escort lists can no longer be relied upon, as they once could be, for giving approximately the total produce of the diggings. This is no mere conjecture, but is susceptible of practical proof in two ways. In the first place, the exports of gold have long been greatly and constantly in excess of the escort produce. Secondly, there can be no serious falling off in the average individual earnings of the diggers, augmented though their numbers have become, inasmuch as the wages of the roughest and most unskilled laborer, (carried on, too, in a languid style, contrasting forcibly with the vigorous and determined mode in which the diggers pursue their more speculative and exciting work) still range from ten to fifteen shillings per day. It would be absurd to suppose that the average earnings of diggers can be very greatly below ten or fifteen shillings per day either. Something below that they may be, for we believe the hope of great occasional gain will be thought to compensate for a vastly greater aggregate of small periodical losses, and that an average earning of eight or nine shillings a day, with hard work and a remote chance of a great prize, possesses attractions equal to those of ten or twelve shillings a day, and very light work without such a chance. Making full allowance for this, however, we should be at a loss to account for the smallness of the aggregate produce, (when we consider the enormous number of diggers now at work,) even were we to take the quantity of gold exported as a criterion; but it is more than probable that large quantities of gold are carried away in passengers' luggage, without ever passing through the Custom House or appearing in the export tables. The fact that of all the numerous gold-freighted vessels that have gone hence to Great Britain, none has yet been attacked, is extremely likely to have produced that sort of feeling of false security that mere habit gives; and as the only object which passengers taking gold with them can have in paying freight, is that of enabling them to insure it, which, without a bill of lading, they could not do, a large number of persons may have begun to think the price paid for security extravagantly high. Robbery they have ceased to dread, and the philosophical reflection, that if the ship goes down, the passengers will probably go down with her, provides satisfactorily for the contingency of wreck. Unless we resort to this explanation, we are at a loss to account for the fact that the shipments of gold have fallen off during the last six weeks, while there has been a considerable increase to the population of the gold fields, and no diminution in the wages of labor.

AVERAGE YIELD OF GOLD ORES.

The general experience of mining shows that the largest results are obtained from poor ores, according to the nature of the metal:—

The gold ores, which are most extensively worked, form no exception to the general mining law. The Brazilian ores produce 8 dwts. 15 grs., 7 dwts. 20 grs., 9 dwts. 4 grs., 9 dwts. 19 grs. per ton, on large quantities of ore. The Columbian, in some cases, yield in mass 12 dwts., 12 dwts. 12 grs., 10 dwts. per ton. The Marcugnaga ores, in Savoy, yield 8 dwts. per ton. The Austrian ores are likewise of low per centage. Even gold sands that yield largely

have only a very small per centage of metal; in the case of those of the Ural only about 2 dwts. per ton, in picked sands.

GARNET AND MOSELY MINE.

The latest report of the Agent states that the crushing of ore proceeded at the rate of 40 tons a day. 122 oz. of gold had been sold to the mint at Philadelphia, which realized between two and three thousand dollars. The mine was last noticed on page 378, Vol. III.

EXTRACTING GOLD FROM PYRITES.

Mr. Evan Hopkins, a mining engineer of considerable experience, thus describes, in the *London Journal*, his operations at the Marmato mines, South America, for the extraction of gold from raw pyrites:—

I have already stated that the Marmato ores are *all pyrites*. I put up machinery capable of reducing 2,000 tons per month on this establishment in 1836, and subsequently made many additions and improvements. This establishment commenced on the system of stamping and subsequent grinding and triturating with mercury, leaving 50 per cent. in the "remains" as unavailable. The use of mercury was abandoned in 1840, and a greater amount of gold was obtained at a less cost; still the "remains" could not be reduced with profit. Various methods were tried from time to time, but without success.

In the beginning of 1846, whilst experimenting on separating machines, I introduced an improvement in the stamps, and by the aid of a different arrangement in the front of the stamps grates, and the application of blankets, &c., we not only increased the produce of the rough ores in the first operation, but succeeded in reducing *all the remains, or tailings, with profit, leaving no available residue behind.*

Had your correspondents a moderate amount of real practical experience in these matters, they would have known that tailings from auriferous ores cannot exist without gold, and that nothing short of their total annihilation can liberate all the gold.

Marmato is still working with profit, and will continue to do so whilst about 1,000 tons a month of pyrites from the mines, containing 1 ounce per ton, at a cheap rate, can be obtained. The tables, showing the results for the months of January and February last, inserted in your Journal, will prove that upwards of 16 dwts. per ton of the rough ore treated is now obtained by means of the subsequent operations, and that at a cost not exceeding 8*s.* 10*d.* per ton for reduction, including all charges. It is simplicity, economy, and great dispatch, that insures profitable results, and not a slow, expensive, and apparent increased product per ton. Your correspondents appear to forget the £ *s. d.* part of the business.

PRODUCTION OF THE RUSSIAN GOLD AND SILVER MINES IN 1851.

From the Annales des Mines.

	Gold.	Silver.	Value of Gold.	Value of Silver.
	Pounds.	Pounds.	Francs.	Francs.
Quantity of pure gold mined, . .	49,724		75,396,216	
Quantity of silver allied with the preceding, ...		4,270		431,708
Quantity of silver mined, . . .		35,120		3,550,101
Quantity of gold allied with preceeding,	1,545		2,344,491	
Total, ...	76,440	58,727	77,740,707	3,981,808

TABLE OF THE QUANTITY OF GOLD OBTAINED BY THE WASHINGS OF AURIFEROUS SAND, IN THE URAL MOUNTAINS, IN 1851.

Impure Gold.	Pure Gold.	Gold alloyed with Silver.
lbs.	lbs.	lbs.
11,970.	10,899.	957. Av.

PRODUCTION OF GOLD MINES OF EASTERN SIBERIA IN 1851.

Tons of Sand washed.	Quantity of Impure Gold obtained.	Number of Workmen daily employed.
4,860,117.	84,673 lbs. Av.	22,832.

The yield of gold varied from 4.67 pennyweights to 23.0 per ton of sand washed.

PRODUCTION OF GOLD MINES OF WESTERN SIBERIA IN 1851.

Tons of Sand washed.	Quantity of Gold obtained.	Number of Workmen.
1,385,517.	5,091 lbs. Av.	7,231.

The yield per ton of sand was 5.14 pennyweights to 7.4.

PRODUCTION OF ARRONDISSEMENT OF HERTSCHINK (EASTERN SIBERIA) FOR 1851.

Tons of Sand washed.	Quantity of Gold obtained.	Number of Workmen.
278,846.	1,225 lbs. Av.	3,698.

QUARTZ CRUSHERS.

Mr. Hermene Gardiner, of New York, has patented in England an improvement in quartz crushers which is thus described:

The nature of my invention consists in making and using an oblong chilled cast iron trough, arranged in a suitable frame, and having on the side rails of the trough frame reversed inclined planes, so as to give a winding rolling motion to a heavy cast iron ball in the trough, as it is made to roll backwards and forwards by means of a connecting rod attached to a crank, and driven by any suitable power, for the purpose of making a machine for crushing and pulverizing earths, quartz rock, or other substance containing any of the precious or baser metals.

Claim.—What I claim is, the crusher trough, having on each side rail reversed inclining planes, for the purpose of giving the ball, as it is propelled backwards and forwards in the trough, a twisting motion, substantially as set forth.

Mr. L. W. Wright has patented in England a crushing machine described as follows:—

It consists of an iron cylinder, revolving on a central shaft, set in action by any prime mover, around which are fixed a number of smaller cast-iron rollers, made to revolve by frictional contact with the central cylinder. The whole is surrounded with suitable framing, and surmounted by a hopper, through which the material is fed, and which being partially pulverized by passing between the several cylinders passes into a receiver below. For the purpose of reducing this to an impalpable powder, a machine is used, constructed somewhat on the principle of the old Chilian mill, the action being reversed. The shafts of the vertical cylindrical crushers are fixed to a suitable framing, and the horizontal circular bed plate, cast with deep flanges, being made to revolve beneath them, they rotate by frictional contact. A third invention under this patent is a washing machine, consisting of a wheel with dashers, caused to revolve in a trough, or vessel, in which the pulverized material is placed, in order to break it up, and well mix it with water fed into it. The water and metallic stuff then flow through a channel into a deep vessel containing an agitator, to which rotatory motion is communicated, when the lighter particles are thrown to the circumference, and the heaviest matter is deposited at the bottom, near the axis of the revolving column.

JOURNAL OF COPPER MINING OPERATIONS.

LAKE SUPERIOR REGION.

The shipments of copper from the Lake Region have already become important this year. The Cliff, National, Minnesota, Forest, North American, Douglass Houghton, Ohio Trap Rock, Ever Green Bluff, Toltec, Bohemian, Ridge, &c., had forwarded some weeks since.

NORTH-WESTERN MINING COMPANY.

The fourth annual report of this Company has recently been issued. It is accompanied with the report of Mr. Slawson, Superintendent of the mine. We have no copy of the diagram alluded to, or we should add it to the report.

The Directors of the North-Western Mining Company of Detroit, have the pleasure to submit their fourth annual report, for the information of stockholders, under circumstances which render their duty peculiarly pleasant and agreeable.

The operations at the mine for the past year have been of such a character as to remove the last doubt of our ultimate success, and to place the North-Western in a most enviable position, in view of the results to be accomplished during the new business year in which we are embarked.

By a careful reference to our past history, it will be seen that while the force upon the mine has been steadily and judiciously increased, as fast as the opening of the ground made room for the introduction of a large number of hands, the demands of the directors upon stockholders, in the form of assessments, instead of increasing likewise, have as steadily diminished.

Thus, in the year 1852, with an average force of sixty hands, the calls upon stockholders amounted to $5.00 per share, or $35,000. In 1853, with an increase of 33⅓ per cent. in laboring force, or say eighty hands and additional cost for machinery, the assessments were but $4.00 per share, or $36,000. We now anticipate, that without accident or other serious impediments, such as we cannot foresee, we shall be able to carry on the business of the Company for the current year, with the single call due the first of last month, of $2.00 per share, $18,000. We calculate upon a very material enlargement of the mining corps in this estimate.

Of course the important results here referred to, are in consequence of gradually increasing shipments of mineral, the conversion and sale of which has contributed materially to lessen the burden, which must otherwise have fallen upon the stockholders.

The first shipment of copper from the North-Western was made in 1852, as stated in last report, and consisted of 13,838 pounds, barrel and mass, yielding 62½ per cent. of pure copper, which was sold at twenty-three cents per pound, giving net proceeds, after deducting expense of freight, smelting, &c., $1,831.94.

During the last year we have received in mineral, as follows, viz.:—In masses, 5,879 pounds. In barrel, or kiln, 23,414 pounds. In No. 1 stamps, 22,771 pounds. In No. 2 stamps, 9,101 pounds. In all, 61,165 pounds, or 30$\frac{113}{2240}$ tons; the net yield of which, in pure copper, was 44,166 pounds, or 72½ per cent. This copper was sold at an average price of 27 cents, delivered in Cleveland, and netted the Company, after deducting freight, smelting charges, &c., $11,229.63.

The Board would take occasion in this place, to refer, in terms of marked approbation, to the manner in which last year's supply of mineral has been dressed and prepared for shipment. It will be noticed that more than the

one-half the entire product was in stamp mineral, and the per centage in copper will compare favorably with any shipments ever made from Lake Superior.

In order to make a clear return of the product of the mine for each year, no account will be taken in the treasurer's report of any mineral not received up to the close of the last preceding shipping year or season of navigation. All mineral, therefore, obtained after the close of navigation, which usually occurs about the first of November, will be passed over to the succeeding term, and will be accounted for in the next report. This is especially the proper course, inasmuch as the product of November and December is not available towards the expenses of the Company until after the period fixed for the annual meeting.

From Mr. Slawson's report, it will be seen that a great improvement has taken place in the mine, particularly during the last few months, and that we have at length the satisfaction to congratulate our shareholders upon the appearance of mass copper, in quantities and of a size to excite our most sanguine expectations.

If this most important element of success should continue, and our vein or veins should yield a fair proportion of mass and barrel ore, which we have every reason to suppose will be the case, we venture to indulge *the hope* that the mine will hereafter pay its own expenses, preliminary to the great object we desire so much to accomplish—of making it a dividend paying concern.

On this head, however, the Board wish it distinctly understood, that they are unwilling to assume the responsibility of making any *positive promises*. They prefer to give a frank and candid statement of the actual condition and affairs of the Company, leaving each shareholder to form his own conclusions, in view of all the facts, with the single assurance on the part of the Board of Directors, that no exertions shall be wanting on their part, to effect the desired object at as early a day as practicable.

We have the pleasure to state, that since the date of the report of the agent of the mine, additional stopes have been taken up, and that the large mass between the twenty and the ten fathom level, north of winze C, has been uncovered to such an extent as to warrant the opinions expressed by Captains Harris, of the Minnesota, and Jennings, of the Rockland Mines, that there is not less than fifty tons now in sight, the end not having yet been reached.

The results, favorable as they undoubtedly are, of our operations during the past year, have not been accomplished without many difficulties and vexations, incident to the business of mining in a comparatively new country. Prominent amongst these difficulties is the great scarcity of hands, and consequent increase of wages, arising from the large number of new mining concerns which have been started all over the country, creating a demand for labor, which the force on hand was inadequate to supply. It is hoped that the interruption of our business from this cause, as well as by reason of the large numbers leaving the country on the opening of navigation, will be only temporary, and that still larger numbers have, by this time, found their way up to the mines, tempted by the certainty of employment at good wages, and by the acknowledged salubrity of the climate.

We have also experienced a great disadvantage, owing to the extraordinary delay in the transmission of machinery, from the various shipping points on the route. From this cause it was found impossible to get our winding engine and pumps in place, and the stack completed, before the cold weather set in, although we presume this difficulty is probably obviated by this time, so that the winding engine has become efficient in relieving the mine of the large accumulations of rock and rubbish in the drift.

Our agent now proposes to convert No. 4 into the engine shaft, for reasons which appear to be satisfactory to the Board. It is therefore intended to enlarge this shaft down to the ten-fathom level, and to continue sinking it

immediately to the forty-fathom level, and to carry No. 3 shaft down to the same depth during the year; to connect these two shafts, and to continue the twenty-fathom level south from No. 2 shaft. This will effectually open our richest belts of ground, and prepare, in addition to the large amount of ground already opened, an extensive field of operations for stoping, during the progress of the other work. We earnestly hope, and confidently expect, that the developments resulting from this plan of operations, will be of such a character as to demonstate fully the wisdom of the policy indicated, and to establish the reputation of the North-Western as a first-rate mine.

Herewith we submit the report of our able and indefatigable Superintendent, Mr. Slawson, which, taken in connection with the foregoing, and the diagram of the underground works, will enable stockholders to form a very correct idea of the present position of the mine in length and depth, the amount of ground stoped and ready for stoping, and generally, of all matters pertaining to the business of the Company at the mine.

MR. SLAWSON'S REPORT.

NORTH-WESTERN MINE, *May* 6, 1854.

Dear Sir:—The following is a report of our operations for the past year, together with the present condition of the mine, and the general statistics connected therewith, and accompanied with a diagram of our underground work:—

Adit level driven	120	feet, average width	2½ feet.
10 fath. " "	189	" " "	2½ "
20 " " "	194	" " "	4
Cross-cut to W C	207	" and drift shaft winze C.	
Shaft No. 4 sunk,	64	"	
Winze C "	33	"	
Driven and sunk	810	"	

Adit level stope	north	No. 3 shaft,	145½ fath.
10 fath. " " "		winze A,	89⅝ "
10 " " " "		shaft 4,	50⅞ "
20 " " "	south	winze B,	26¾ "
20 " " "	north	winze C,	21⅛ "
Total stope, . . .			333¾ "

The thickness of the veins varies from 2½ to 4 feet of mass, barrel and stamp work.

There is now open some two thousand fathoms, the majority of which is good stoping ground, and the mine has been and is steadily improving as the workings advance. It has improved fifty per cent. within the last three months, and has proved its title to being something more than a stamp worked mine. Masses are showing themselves in various parts, and its general appearance is most encouraging. The vein in twenty-fathoms level shaft, winze C, one hundred and twenty-four feet from the winze, is one and a half feet wide, mass, barrel and stamp. North of winze C, in same level, I have driven one hundred feet vein in breast, three feet wide (average width given above). In the first stope north of winze C, in this level, met with some small masses of from four hundred to one thousand pounds, and have commenced two more stopes in same place, and have taken down already five masses, now lying in the drift ready to take out; they will weigh about ten thousand pounds, and there is now in the back of these stopes a mass uncovered for twenty-five feet in length and six feet in height; the part of it exposed is estimated to weigh at least twenty tons. I cannot yet determine its extent, but by all appearances it will turn out twenty tons. The vein in ten-fathom level, north from shaft No. 4,

is two feet wide; in the bottom of this drift, there is a mass exposed some twelve feet long, estimated at two tons, and we have taken down to-day, from stope in this level, north shaft 4, a mass that will weigh sixteen hundred pounds. The vein in adit level has been very large and rich for the last one hundred feet; at this time it is small; we are close to the slide and do not look for much copper as we approach it. The vein in stope north of No. 4 shaft in this level is four and a half feet wide; there is a mass hanging in back of stope, but of what size I cannot say. In the stope north No. 3, the vein is four feet wide, mass, barrel and stamp work. There is at this time in sight thirty tons of mass copper. We have been running one axle, carrying eight head of stamps, nearly constantly since 5th of January last, and the other axle, carrying eight additional head, is now nearly ready for operation; the eight head run by the new axle, stamp fully one-third more rock in the same time than the twelve head worked by the old axle, which was laid aside on account of the defective arrangement of the mortises. Another dam has been built below the stamp house, which receives the water after passing through the washing floors, and by the aid of the pump sent up last fall, and now in successful operation, we have an abundant supply of water, and our arrangements for stamping and washing are now second to none on the lake. Owing to the very late arrival of the machinery, both of the winding engine and pump for the mine, and the stamp axles and the pump for the washing floors, I found it necessary to discontinue work on one of them, and concluded it would be more conducive to the interests of the Company to go on with the stamps, more especially so, as the stack for the engine had not been completed to a sufficient height to give draft enough to enable us to raise steam readily for the efficient working of the engine. The engine, however, is up and in running order, and I anticipate having the winding apparatus in operation by the first of June, and the difficulty we have labored under during the winter of keeping the mine clear of rock will be obviated, and a considerable addition to our mining force can then be profitably employed. The saw-mill is in successful operation; the amount of lumber sawed during the year was 333,907 feet. Of this amount there was sawed

20,590 feet for Copper Falls mine,
57,942 " " Summit mine,
11,860 " " Winthrop mine,
21,223 " " Dana mine,

making 111,655 feet at the rate of $6 per M. The new road from the mine to the harbor, has been completed, and the increased facilities it affords to transportation of supplies and copper fully compensates for its cost, our share of which was $679.15.

The present working force of the mine consists of about ninety-five hands, thirty of whom are miners, whose average earnings for the year have been $30.46 per month; and sixty-five surface hands, including two smiths, two carpenters, two engineers, one copper dresser, beside the superintendent and clerk. The average wages of surface men, including wheelers, mechanics, &c., has been $21.12 per month. There are about one hundred acres of land cleared, fifty of which are under cultivation. The farm products last year were, 10 tons hay, 200 bushels oats, 1,338 bushels potatoes, and 409 bushels turnips. We have on hand per inventory, estimated, 100,000 feet lumber, 75,000 shingles, 400 bushels coal, and 1,200 cords of wood. Our live stock consists of 8 horses, 2 oxen, 1 mule. We have 4 wagons, 1 cart, 4 sleighs, and 26 buildings, of all kinds, on the premises, for estimated value of which, together with supplies on hand, see inventory. Our indebtedness at mine for all accounts on the first day of May, and subject to draft at sight, estimated at $15,000. We have at the harbor, ready for shipment, 50,462 lbs. copper, and at the mine (which will be sent to the harbor next week), 15,830 pounds, making a total of 66,292 pounds, or 33¼ tons. This consists of 27,555 pounds No. 1 stamp, 4,974 lbs. No. 2, 5,480 lbs. No. 3, 12,778 lbs.

kiln, and 15,505 lbs. mass copper. This does not include any of the copper I mentioned as being in the mine, and the weights given are the net weights. The packages added would make the entire amount over 34½ tons.

I have now given you all the data in regard to the mine, and will express my confident belief, that the North-Western is yet destined to rank among the A No. 1 mines on the lake, and my belief also, that the result of the present year's work will place this matter beyond cavil.

Yours respectfully,

JOHN SLAWSON,
Agent North-Western Mining Company.

MR. JAMES M. COOPER.

The Board have only to add, that they have reason to believe that the assistants of Mr. Slawson, in the various branches of the Company's service, have fully and faithfully performed all the duties of their several posts.

Mr. John S. Blaine, our very efficient clerk, has particularly distinguished himself by his zealous and unremitting attention in the department confided to his care.

The balance sheet from the Treasurer's books, and the statement of assets and liabilities herewith, furnish a complete exhibit of the finances and present resources of the Company, being all the additional information, necessary to a perfect understanding of our affairs, which it is now in the power of the Board to impart.

All of which is respectfully submitted.

J. K. MOORHEAD,
C. G. HUSSEY,
THOMAS M. HOWE,
JAMES M. COOPER,
H. N. WALKER,
Directors N. W. Mining Co. of Detroit.

Winthrop Mine.—Under date of June 17th, Mr. Hill thus writes:—

The Hill vein of Copper Falls location *has been traced on to the Winthrop lands, and found to be strongly marked throughout the property*, and we shall commence a shaft in a few days.

Toltec Mine.—A letter from the Superintendent, Mr. Sales, says:—

I arrived home two weeks ago and found everything in good shape, and the mine is looking first-rate. I do not think worth while to describe every part of the mine in detail, but we have a good strong lode at every point working in the mine. We shall want forty heads of stamps for the Toltec mine.

Algomah Mine.—From this mine we learn the following particulars:—

I am working sixteen men, part getting out timber, and part exploring further east for the vein. We have opened the vein 250 feet east of No. 2 shaft, and the vein is from two to three feet wide, thickly charged with copper. I shall commence sinking two new shafts in a few days.

Phœnix Mine.—Later reports state as follows:—

In a few days more we shall have the old Phœnix vein opened on the south side of the ridge, in one of the finest situations for working yet seen among any of the mines, south of the crystalline trap. I have carefully traced it south, and know that we are certain to find it in a few days on the south side of the ridge.

Ripley Mine.—A letter from the Treasurer says:—

I have the pleasure of informing you that they have struck a vein in the Ripley that promises very well indeed. It resembles Portage vein in every respect, and has been opened on each side of the creek near the centre of section 30.

New England Mining Company.—The following particulars respecting

the locality, etc., of some new mines described by the *Lake Superior Journal*, are important:—

The most easterly copper mine on the south shore of Lake Superior, is that of the New England Mining Company, situated on Point Keweenaw. It is a new concern, under the superintendence of Edward Taylor, Esq., an able and experienced manager. Very little has been done as yet, except to explore the vein on which the mine work is to be commenced, which is reported one of fair width and richness at the surface, and one that warrants a handsome expenditure of means to prove its value. The location will be valuable, if the mine should prove successful, as it is near the Lake, and easy of access.

Keweenaw Mine.—A short distance to the west of the New England is the Keweenaw Mine, on the south side of the range, under the supervision of John Hoar, Esq., an able and experienced miner. The Company have on their location two promising veins, which are now in the process of being opened. Several shafts are going down and the work prosecuted vigorously. The lodes are of good size and carry considerable copper, and promise fairly for the shareholders.

Copper Harbor Company.—About three miles further to the west, a new Company have just commenced work, exploring for veins, called the Copper Harbor Mining Company. The location is said to be valuable in surface indication, and will be thoroughly examined this season preparatory to the commencement of mining in the fall. F. P. Harrington, of the Manitou Mine, has the care of this new concern.

Star Mine.—The Star Mine is situated on the south side of the range, about one mile west of the last. James Everington, Esq., has the superintendence of this mine, and is prosecuting the work with energy. He employs thirty-three men in all, half of whom are miners. The lowest shaft is down 80 feet, from the bottom of which they are drifting north on the course of the vein. They are driving up an adit of eight hundred feet in length, which will give the mine a drainage of eighty feet or more, and will greatly facilitate the mine work. The vein is wide, averaging at least three feet, and well filled with stamp copper, and they have some five hundred tons of this kind of work at the surface ready for stamping. At the surface there are many substantial improvements—they have some eight or ten pleasant dwelling-houses and other buildings, and some fifteen acres cleared.

Clark Mine.—North of the Star, on the north side of the bluff, is the Clark Mine, a concern recently started and now attracting considerable attention from the amount of mass copper found near the surface. A shaft has been sunk about thirty feet, and an adit run in on the course of the vein about fifty feet, and with this amount of work several hundred pounds of small masses of copper and excellent stamp work have been taken out. The vein is two feet wide, and rich, and promises well for the future.

Mr. Northrup has charge of this mine, and he has made a good beginning for a mine. This is only three miles from Copper Harbor, and well situated for mining economically.

Iron City Mine.—Passing by the Cape Mine, now abandoned, a mile west of the Manitou, we come to the Iron City Mine, about three miles west of the Manitou. Considerable work has been done on this mine for several years past, without producing any valuable results. Mr. O'Conner, the able agent, has explored, both above and below ground, and found several veins, but none of them rich in copper. A small force is now only worked. This Company have a large tract of land and some valuable surface improvements. By a recent destructive fire that swept through that vicinity, the Company had four buildings, three hundred cords of wood, and a number of acres of oats and potatoes destroyed, compelling several families to leave the location.

Empire Mine.—The Empire Mine is situated directly north of the Iron City, on the northern slope of the mineral range, about three and a half miles from Copper Harbor. The numerous veins of the south side appear to concentrate

into one main vein of great strength and richness, it having been easily traced for more than half a mile across the location, and everywhere being well-defined and full of copper.

Bluff Mine.—A mile west of the Iron City is the Bluff Mine, under the superintendence of S. H. Broughton, Esq. Considerable work was done on this location before they began to find much copper. But the farther the vein has been opened the better it is, and they are continuing to prosecute the work with energy and with a fair chance for ultimate success. This location, or the mine, is on the south side of the bluff. They have a fine clearing and a number of acres planted this season. They are employing now about 20 men, miners and surface men.

Continental Mine.—Two and a half miles west of the Empire, in the same belt of trap, is situated the Continental Mine. This is a Company started late last fall, under the general superintendence of S. W. Hill, Esq., of the Copper Falls Mine, and under the immediate charge of Mr. F. H. McCarty. A large and well-defined vein was discovered on the location last fall, and mining was commenced early in the winter, by sinking on two shafts which were not carried down but a few feet on account of the influx of water from the spring rains and melting snow. We believe an adit is about to be run up from the small lake adjoining, which will drain the surface water and enable them to go to work again on the shafts. The bottom of the shafts looked well—the vein is large and well-defined, with some copper, and the prospects are far from being discouraging for the Company.

NORTH CAROLINA COPPER COMPANY.

The following is a statement made by the Committee appointed to report on the affairs of the North Carolina Copper Company:—

Total number of shares issued, as per certificates of stock, .	90,435
Transfers not represented by certificates, ...	9,565
Total, ...	100,000

At $5 per share.

The Treasurer's balance sheet represents the following state of affairs:

Dr.		Cr.	
Superintendent Mines,	$3,982 52	Bills payable, ...	$11,500 00
Mining expenses, . .	58,703 25	Treasurer's account, .	29,353 04
Construction account,	17,329 22	Copper ore account, . .	49,322 96
Office expenses, . .	6,512 23		
Contingent expenses,	3,650 78		$90,176 00
	$90,176 00		

The item Superintendent of Mines, represents the cash on hand at the mine, as well as the items disbursed not audited.

The mining expenses include miners' wages, salary of Superintendent and Captain, supplies for miners' use, transportation and freight of ores, &c., &c., stoping, &c.

The construction account embraces the cost of machinery, buildings, tools, &c., &c.

The office expenses include office fixtures, rent, salaries, &c., &c., part being for the office at the mines.

The contingent expenses include the item of $2,600 for passage of miners to the works, which was necessitated by the demand for skillful workmen, the past summer.

The following is a statement of the business of the mine since its opening (a period of nineteen months).

Total amount of expenditures for ranges, supplies, dead work, buildings, &c., &c., under the different heads given, . . . $86,192

Of which the estimated expense of raising and barrelling the ores, &c., is, ... $38,066.

Extraordinary expenditures, ... $48,186

The Committee consider that these outlays having been incurred for dead work, buildings, machinery, tools, etc., etc., will not have to be incurred again, and feel confident that the mine is capable of making profitable returns, provided none but No. 1 ore be sent to market—it being estimated that fifty tons per month of this ore will suffice to get the Company out of debt, and pay the required advance in twelve months, and the mine being, in the opinion of competent miners, able to turn out a much larger quantity. The Committee also find that the books of the Company have been correctly kept, as well as also the issues of the stock, and the vouchers for expenditures satisfactory in all particulars.

STANTON COPPER COMPANY, OF MISSOURI.

We are indebted to the *St. Louis News* for the following particulars respecting the flattering prospects of this Company :—

The first lot of copper by the Pacific Railroad came in lately, from the Stanton Copper Works, on the Meramec.

It is of superior quality, and goes to the Boston market, where it brings a price equal to the best pig copper in the world. The Company now have their mine and smelting furnaces in complete operation. The former is worked by a steam-engine and horse whims, and is now explored to a depth to warrant the belief that the mine is inexhaustible.

Sixty thousand pounds of pig copper have been obtained from a smaller space, and nearer the surface, and with less than half the expense, than a similar amount from the great Cliff Mine, on Lake Superior, which last year yielded ten per cent. profit on a million of dollars.

The old Stanton Copper Company was a private partnership, but has been converted into a corporate body, under the name of the "Stanton Copper Mining Company," for the purpose of enlarging their working.

Their capital is $60,000—divided into 15,000 shares of four dollars each; most of which is already subscribed for, and the full amount of each share thus subscribed for paid up.

The copper sent to this city within a few weeks past, and taken from the mine since March, would amount to six per cent. on the capital stock. The development and yield of ore at this mine will soon convince capitalists that the copper mines of Missouri offer inducements for investment of the most flattering character.

The new Company intend soon to publish a detailed account of their mine and furnaces, which no doubt will form the commencement of a new era in the mineral business of Missouri.

MINERAL LANDS IN THE ISLAND OF JAMAICA.

A recent exploration of the copper bearing rocks of the central and eastern portion of the island of Jamaica, W. I., has been made by Dr. Isaiah Deck, of this city. Some of the important results of this examination are valuable, and we herewith spread them before our readers :—

The mining properties comprise about 4,000 acres of rich agricultural and plantation land, situated in different parts of the Parishes of Metcalf, St. Andrews, and St. Thomas-in-the-Vale, being equidistant about 20 miles from Kingston on the south, and 6 to 10 miles from Ports Maria and Annatto Bay on the north; there is conveyance from the different lodes by bridle roads for

mules to Mount Ogle, 5 miles; thence to Kingston 15 miles by carts or wagons—direct to the wharf whence it can be shipped to any American port.

The water power in the vicinity of all the lodes is abundant, and continuous for driving powerful machinery for crushing and dressing the ore, etc.—while timber for mining works and shafting is equally plentiful, and of good enduring quality. The lodes are mostly on levels and sides of hills and ravines, and could be most favorably worked by driving adits, side levels, and galleries on them, without the present necessity of sinking shafts. The accumulation of water in the mines would be very trifling in the most unfavorable seasons, and the adits could be contrived to drain them sufficiently, (owing to the peculiar geological formation,) without the aid of pumps.

Many of the lodes are sufficiently developed to commence active and remunerative work; some, in fact, will pay liberally, and others probably clear their expenses while being further opened. Labor is much more reasonable than in the United States; 50 cents per day, without board or lodging, for the native laborers, is thought by them to be a large price. Any number can be engaged on these terms, while the introduction of white overlookers will exert a most healthy influence on the habits of the natives.

The geological features of the mineral districts are varied and highly marked, a white corralline and magnesian limestone, almost bounding the entire N. and S. E. of the island, and on approaching towards the mines from Kingston, upheaved transition rocks thickly interspersed with trap dikes and protrusions, and alternating with porphyritic granite, and red sandstone conglomerate, are the most prominent. The transition, or submedial rocks, embrace all mines hitherto worked on the N. E. end of the island, while those lands I principally examined, are included in the above, together with the porphyritic trap, and old red sandstone conglomerate, and much granite. You thus in your land comprise those metalliferous strata which we know to be hitherto profitably worked by existing Companies, and also those which experience has shown to be the source of some of the best Cornish and Australian mines; viz., granite, and red sandstone.

I surveyed, and closely examined, about twenty-five openings or cuttings, where there were favorable indications, and in some instances adits, or levels worked to some extent; of these I have selected fourteen as being the most promising, easily worked, and in a condition to pay shortly for the labor expended.

These were in the district of "Mahoney," (600 acres in the parishes of St. Andrews and St. Thomas,) two lodes.

"Dublin Castle" district (500 acres in Metcalf parish) 4 lodes; "Mount Royal" do., 3 lodes; "Providence," 1 lode; "Belmont," 1 lode; "Chesterfield," 2; "Mount Airy," 1 lode. In addition to these fourteen, I examined a most favorble indication, situate at Mount Ogle, the nearest point to Kingston, and from operations which had been immediately commenced on it, and the encouraging aspect it presented the day before my leaving the island, I am disposed to think it will be one of the most valuable lodes.

I am of opinion that if these 14 lodes were concentrated into 9 or 10, and commenced at once, it would be a fairer and more profitable method of distributing the labor. I will give a brief outline of these workable veins; and the similarity of their course and dip and their general regular features will be at once evident, and a great argument in favor of their being true veins.—Most of them have been traced considerable distances, and their continuity is undoubted by all who are acquainted with the localities.

"Mahoney," 2 lodes: No. 1 (3 in list); excellent, and traced through ridges on each side, N. E. and S. W.; here an adit should be driven in ravine much below the lode, to intersect it.

No. 2; (4 in list); vein good near brook, excellent indications, dip 36° N. E. by E.—no strike.

These were fair average lodes, and running much in the same course, and

having the same geological formations, being in a friable clay porphyry and amygdaloid rock; the ore is a yellow and purple sulphuret, mixed with specular iron, and yielding in its average some 23 per cent., it can be dressed much higher. In working No. 2, it will be advisable to sink 20 feet down on the vein following its course, etc.

"Dublin Castle," 4 lodes: No. 1, an adit has been driven in four fathoms, and has cross-cut the lode here three feet wide. As it descends it gets richer, dips 35 N. W. and S. E. Fifteen tons of an excellent quality have been taken from here.

No. 2, across brook and on level with No. 1 at some hundred yards—probably same vein, as its course is very similar.

No. 3, in bed of the brook, which can readily be turned. This runs towards Taylor's land, and is a very fair lode of green and blue carbonate and sulphuret—a large specimen of 100 lbs. weight, in commercial rooms at Kingston, was taken from this lode.

No. 4. This is opposite, and in "Duncan's Lot." There is a fine vein near bed of river, and has been profitably worked. It is a fine gray sulphuret of copper.

These four lodes will probably begin to pay for the labor at once—the locality is favorable for working, and abundance of water power handy. They have strongly marked features, and have already produced enough ore to prove them true veins. They are composed of yellow and gray sulphurets, and green carbonate and oxides, and will yield by dressing, 30 per cent. of copper.

"Mount Royal," 3 lodes; No. 1, an excellent vein, interspersed with mundic, with yellow and green carbonates of copper.

No. 2, a rich vein running across brook, N. W. and S. E., from 6 to 18 inches wide at the surface, dip 30° S. W., it is a pure liver and gray sulphuret, yielding *at least* 50 per cent. of copper.

No. 3, a good gangue of quartz rock, inclosing a wide and excellent lode of sulphurets. Dip 30 N. by W.; strike N. E. by E.

These veins are of the highest aspect, and should have preference of others to begin upon. They would immediately pay, and establish their character to true veins, yielding from 40 to 50 per cent.

"Belmont," 1 lode on "Matty's Lot;" a very excellent indication, and the best of the Belmont property. Dip N. E. by N., S. W. by S., 23 degrees; strike, due north; a green carbonate and yellow pyrites, giving over 22 per cent.

"Providence," 1 lode, vein near school-house; most excellent indications, and a wide lode of 4 feet. Dip, 50 degrees, N. by W., S. by E.

This lode is visible 100 fathoms off, and can be traced a mile.

These ores from Dublin Castle and Belmont, could be dressed at the river nearest their different localities, about midway from each.

"Chesterfield," 2 lodes; No. 1, three feet wide, and looks more promising; gangue a hard quartzose rock, containing veins of gray and green ore, course N. E. by E., S. W. by W., not opened on its entire back.

No. 2 has been partly worked, and some excellent lots of green carbonate and gray sulphuret taken out.

In this lode, the gangue is composed of indurated red clay, and largely interspersed with crystalline sulphate of baryta (heavy spar). This is a favorable omen, and I consider the promising appearance of these lodes, and their average richness, 33 per cent., to be scarcely below any others.

"Mount Airy," 1 lode—near the brook and waterfall. The width of the lode is three feet, and contains veins of good purple copper, from ¼ to 8 inches wide, running through it; and with well defined walls and gangue—course, N. by E., S. by W., dip 26 degrees N. by W. This lode can be traced a considerable distance, and is very favorably placed for working. The analy-

sis of the lode itself, gives 29 per cent. of copper, and if the pure ore were picked from it, would give 53 per cent.

Mount Ogle lode, although scarcely sufficiently developed on my leaving the island, I consider to be one of the most promising from present indications. It is well defined in a gangue of decomposing granite, killas, and talcose slate, has a wall inclosing it, and takes a course in a similar direction to the other lodes, dipping 35 degrees to north. This is being rapidly proceeded with, and late accounts are most flattering.

In addition to these workable lodes, there are many other positive indications distributed over the entire district comprised in the mining property—these can be reserved for future explorations, and I would advise all the labor and energy to be at once concentrated on the fifteen lodes, to be reduced to ten if thought prudent.

From calculations I have made upon the productiveness of the above lodes, I estimate from 36 to 40 tons per month of dressed ore, equal to 36 per cent. richness, can be obtained, and worth above $200 per ton, (occasionally nodules of ore of over 60 per cent. are met with in some of the lodes,) but I have assumed the above per centage as being quite within the average results, by which I have practically estimated the value of the ore; and as veins increase in depth, it is an axiom that their richness increases.

A force of from thirty to forty men, including overlookers, would be amply sufficient to work these veins. I am not prepared to give an estimate of their cost, but I consider the quoted returns will leave a wide margin for profits, as the ore can be brought direct from the mines to New York or Boston, at a cost of transport and freightage under $20 per ton.

The first shipment of the ore from these veins, was made some months since, and consigned to the Revere Copper Co. of Boston; it was smelted by them, and stated to be of very desirable quality, and yielded 24½ per cent. of copper. This ore was shipped as taken from the mine by native laborers, without the slightest dressing, and it was much intermixed with gangue and rock; it is but fair to assume, therefore, that when moderate labor is expended on its trimming, it will be nearly double the per centage.

I consider all these veins most promising in present appearance and general character; therefore I am disposed to advance these geological data and facts, to sustain me in the assertion of their being true veins of intrusion.

1st. The almost uniform direction in which they run compared with each other; their course being mostly N. E. and S. W., this is also a favorable circumstance compared with well known productive copper veins in a similar age and deposit.

In England—in Cornwall, Devonshire, and Staffordshire, where the average of copper ores rarely exceed 8 or 10 per cent. in richness, the course of the lodes is east and west. But the Burra Burra mines in Australia in limestone, and the New Zealand mines in granite, and some of the richest mines known, run invariably N. by E., S. by W., a similar course to these Jamaica lodes, which are in granite and a decomposing porphyritic loadstone and limestone.

2d. The fact of these veins not being in the same plane or direction of the strata or "country," running in most instances obliquely to, and intersecting it, showing them not to have been deposited in flattened masses with it, but injected in true veins and fissures; the altered nature of the rocks in immediate contact with the veins strongly advocates their igneous origin, further strengthened by the evidence of their increasing in width and richness as they are followed downwards.

3d. Their almost universal direction being parallel to the general course of the great and continuous valleys which intersect the central portion of the island.

By this it must be understood as varying direct from the ravines and smaller basins, which being bounded by spurs and shoots projected from the

sides of high mountains, are mostly at right angles with the plane of their extension.

As a mining geologist, I with deference submit the above as positive evidence of their being permanent veins, or in the immediate locality of some immense main source of copper, as indications are numerous over the range of country I have surveyed, and they have been traced over many thousand acres during my examination.

AMERICAN MINING COMPANY'S MONTHLY REPORT FROM THE MINES.

Prepared for the Mining Magazine, by E. P. Wood, M. D.

Norwich Mine.—[From Col. W. E. Trask, June 8th, 1854.]—At the Norwich Mine 35 miners are now at work driving and stoping west, and are driving up to the copper masses as fast as possible. I have never seen in the mine so much copper in sight. The stope is unusually rich in barrel and stamp work. Two kilns will be kept constantly roasting "stamp work" from this time. We get from 1000 to 2000 pounds of copper from each kiln.

Same, dated June 19th, 1854.—I have this afternoon been through the Norwich Mine with Captain McDonald, and it certainly looks well, and all parts are being worked with energy. There are 57 men underground stoping and taking down rich stamp and barrel work, and to-day a mass of 900 pounds. The stopes are now up to the large mass, and it will soon be out. The water drift is now up, and another battery of stamps, making 12 in all. The surface work is also well up. A full force of men in all parts, and all the work goes on with satisfactory energy.

Same, July 8th, 1854.—The Norwich Mine never looked better. Twelve stamps are at work now night and day, and are doing great work. All places in the mine are filled with miners taking down the lode.

Windsor Mine.—[From Col. W. E. Trask, June 22d, 1854.]—I was through the Windsor Mine yesterday, and it certainly looks very promising. The mine has been regularly opened, and meets with the approbation of all mining men. The miners are stoping up to the mass in the winze, and will take it down in the regular course of mining. This mass is 14 feet high; I am unable to give the breadth. It is larger than the winze, and will probably weigh 4 or 5 tons. The lode is also rich in stamp and barrel work. No time should be lost in getting up stamps at this mine, as it will give a large amount of stamp work, and would now give sufficient for 16 or 20 head of stamps.

Derby Mine.—[From S. S. Robinson, Agent, June 3d, 1854.]—At the Derby we are down 79 feet in the old shaft, on the south vein, which is the only shaft we have been working this last month. The vein is looking more promising than I have ever seen it, and carrying more copper. The copper taken from the shaft now has that bright look which the miners term "*healthy*," and is in size from the smallest speck to ¼ an ounce in weight.

From the same, dated July 1st.—The Derby is now down 98 feet on the south vein. Shall commence drifting east on the vein this month. The point 300 feet east on this vein, where we have been prospecting, looks quite promising.

Same, dated July 12th, 1854.—The mine is now looking quite well, as well as I ever saw it. This month we recommenced sinking the shaft on the north vein, and it is now looking finely, better than ever before. The vein is large, and carrying good stamp work in both quartz and epidote; it is also regular as any vein in the country, has good walls, and improves in richness as we sink on it. The south shaft is now looking better again; we have commenced drifting east on the vein at a depth of 85 feet.

Sharon Mine.—[From S. S. Robinson, June 3d, 1854.]—At the Sharon we are down in shaft No. 1, south vein, 50 feet, and it has the same promising appearance as when I wrote you last. We have only been working the mine at this point the last month, men having been very scarce, but we hope now to be able to drive the work with vigor.

Same, dated July 1st, 1854.—The Sharon Mine looks as well as ever. We are down 56 feet on the south vein. The vein is defined by good walls, and is now from 18 inches to 3 feet wide, well charged with copper, and the present indications are that the ground will probably not be any harder than at the Windsor.

Cabarrus Mine, North Carolina.—[Extract of a letter from William Everborn, Mining Captain, dated July 1st, 1854.]—We commenced work on the Damascus vein this week, sunk one shaft, and have it well timbered fifteen feet. The shaft is five by eight feet. The bottom of the shaft is two feet below the old workings. In sinking these two feet, we have taken out twenty bushels of good ore. It is sulphuret and brown ore mixed with the quartz. The vein is twelve inches wide, and regular across the shaft; pans gold well, and gold can be seen in many of the pieces of ore with the naked eye, and will make about one pennyweight per bushel or more.

From A. A. Parker, Esq., General Agent, July 2d, 1854.—The steam engine is nearly all ready for steam. Crushers are set—bunter in—conveyer being put in, and elevator casings in progress. Pulverizer gearing all set, and the pulverizer partly set. The men in engine shaft are clearing out the old drift to the end, so as to take out ore as soon as the machinery is all ready to start.

From same, July 19th, 1854.—We are getting along as smoothly and rapidly with the fixtures as could be expected. Our eight separators are set up, and fit with great exactness. Men in drift drove and cleared up four feet of old drift and stope. The men, exploring for vein, hit it in the "cotton patch," some 400 feet east from shaft; it is seven inches wide, and looks about as it did at last point hit, and contains gold.

San Augustine Mine, Cuba.—[Extracts of letters from H. P. Chamberlain, Esq., Agent, dated June 19th, 1854.]—"The lode in east level of the winze is looking extremely well. It is laid open about five feet wide, going in an easterly direction. The part of the lode laid open now is composed of a very hand, some white brittle spar in the back and north side. The ore is black, and coated yellow. In the bottom it forms more solid, and is the same kind of yellow copper as we had in the other part of the winze.

From same, July 1st, 1854.—Our work the past month has been confined to the winze altogether. To the west we drove a level from the bottom on the northerly side, twenty feet in through very good killas, and interspersed with bunches of spar containing ore in detached spots. Opposite, we also commenced another level to the east. At the distance of three fathoms we came upon beautiful white spar and a fine fluking, with abundance of mundic and some black copper. This we followed into for the distance of two fathoms, yielding a fine return of coated ore in the back and end, and growing more massive in the bottom. The lode here, as in its first appearance in the winze, seemed to be crossing the regular east and west ore, and making heavier further down.

THE CABARRUS MINE.

The following interesting statement presents a general survey of the entire operations at the Cabarrus Mine, mentioned in the monthly report above of the American Mining Company. It is from the pen of Mr. James M. Henderson, Editor of the *Gazette*, which is published at Concord, in the neighborhood of the mine:—

It is owned and worked by the "American Mining Company," of Vermont. From the reports we have seen in the New York *Mining Magazine*, one of the first mining journals of the age, the same Company are working some five mines on Lake Superior, four in Cuba, two lead mines in Wisconsin, and

several other mines in different parts of the United States, and are now just turning their attention to the gold fields of Carolina.

At a point six miles east of this town, they have already erected an engine house—a substantial frame building, 36 × 36 feet; adjoining it is a mill for grinding and pulverizing the ore, and separating it from the sands. This building is 43 × 43 feet, and is perhaps the strongest building in this part of the gold district. An office, barn, and machine shop are already erected, and some fifty men are now under the employment of the Company, completing the buildings, erecting the machinery, and taking out the ore.

A few years ago an agent of this Company was sent out through the gold fields of Virginia and the Carolinas, with orders to select the most promising location he could procure in the district, and after securing the title to such an amount of territory as would insure to them an abundant supply of ore, report to them the richness and probable quality of the ore. After visiting the entire gold fields of the South, he settled the present site for their future operations, and secured by lease and purchase some three thousand acres of land around and in the neighborhood of the mills, and they are now getting under full operation.

The vein at the mills has been proved up for some two thousand feet, and has already produced some two thousand bushels of ore, which yielded on these temporary mills of the country something like one dollar thirty-seven cents per bushel. Their shaft is now about one hundred feet deep, and one drift extends one hundred feet east, in which the vein will average some eighteen inches in width, varying from six inches to three feet.

At another part, some two miles from the mills, they are working a vein averaging twelve inches in width, from which two men last week, in two days, took out two hundred bushels of gold ore, worth, by estimation, from one dollar to one dollar and fifty cents per bushel. The large amount of mineral lands leased by this Company in the immediate vicinity of their mills will insure them an almost inexhaustible amount of ore for years to come. At one of the tracts leased by the Company it is estimated that a very large amount of ore can be raised to the surface, which has heretofore produced one and one-half pennyweights of pure gold to the bushel, at an expense of from twenty-five to fifty cents per ton. This place was formerly worked by General Barringer, of this county, and George Miller, long before any mills were erected for the purpose of separating the ore, except by the then usual method of crushing it in a mortar with a pestle.

The agents used in the separation of these ores are "Bradford's Ore Separators." Eight of them are now in process of erection, of sufficient capacity to crush twenty-five tons of ore per day—equal to five hundred bushels. By this process (samples of which are in our office for inspection) all the loose earth and sands are thrown off by the first process, and the sulphates, and all metallic particles of gold or copper ore, are concentrated and collected by themselves.

By a process peculiar to themselves, all the sulphur is expelled from this concentration, and it is then treated for the gold alone, by which, too, the copper is saved as well as the gold.

The quartz is crushed by means of the old Cornish Crusher, and from it the ore goes into T. O. Cutler's Pulverizer, which is warranted to grind as fine as necessary twenty-five tons per day, and average it from day to day. The buildings are of sufficient capacity for two sets of mills to reduce, without additional buildings, one thousand bushels per day.

We wish this Company, as well as all others employed in developing the resources of Cabarrus, much success. They do not seem to have come here for the purpose of speculation, but for the purpose of opening and developing the mineral wealth of this county, and deriving a profit by mining, and not by speculating in stocks.

JOURNAL OF SILVER AND LEAD MINING OPERATIONS.

EXPORT OF MINERAL FROM CALDERA, CHILI.

On page 37, Vol. III., is a statement of the exports of silver and copper from the port of Caldera, in Chili, S. A., during 1851, 1852, and three-quarters of 1853. The entire export for 1853 was as follows:—

Quantity.			Value.
Marcs of Gold, . .	560¾,	@ 25 dollars per marc, .	$70,094 9
" Silver Bars, . .	228,197,	@ 9 " 75 . .	3,199,920 75
Qtls. Mineral Frio, . .	116,961 4-5,	@ 15 " qtls. .	1,754,427
" Copper Bars, . .	894 4-5,	@ 16 " " .	14,316 80
" Crude Mineral, . .	144,546 4-5,	@ 2 80-100 " .	361,367
			$5,400,125 64

THE ENGLISH LEAD TRADE.

The prices of common pig-lead in London from the year 1830 down to, and including, the year 1843:—

1830 . .	£13 0 0-	£13 10 0	
1831 . .	14 0 0-	13 0 0	
1832 . .	12 10 0-	12 0 0	
1833 . .	12 0 0-	15 0 0	
1834 . .	15 10 0-	18 0 0	
1835 . .	18 0 0-	20 0 0	
1836 . .	21 0 0-	28 10 0-	£24 0 0
1837 . .	24 0 0-	18 10 0-	20 10 0
1838 . .	20 19 0-	21 10 0-	10 15 0
1839 . .	19 10 0-	18 10 0	——
1840 . .	18 0 0-	19 10 0	——
1841 . .	20 0 0-	19 10 0	——
1842 . .	19 10 0-	17 15 0	——
1843 . .	17 10 0-	16 5 0-	17 0 0

The difference of price at Newcastle generally averages 10*s.* per ton less.

GRAN POBRE MINE, VENEZUELA.

Operations at this mine are progressing, under the supervision of Mr. Kessler, whose report upon the property will be found at page 121, Vol. II. A letter from there, dated June 20th, states: "That the galena is most abundant, and equal in richness to any heretofore extracted; and the work promises the most satisfactory results, both to the proprietors and to the lessors."

RIVILLA SILVER MINING COMPANY.

The capital is 200 shares, at $100 each, amounting to $20,000.

The Directors are: Sr. Dn. Tiburcio Rodriguez de Triarte, President; Mr. Robert Syers; Sr. Dn. Genaro de Legóburu; Treasurer, Sr. Dn. Manuel Sojo; Mining Engineer, Mr. Charles Kessler.

The Company was formed in Venezuela, and the directors reside at La Guayra, the seaport of Caracas, capital of Venezuela.

Seventy-five dollars have been paid in thus far on each share; and according to the last news received from La Guayra, the shareholders, owing to the very rich discoveries of silver and gold made in the mine, were asking $700 per share.

The owners of this mine are: Sr. Tiburcio Rodriguez, Sr. Riman Rodriguez, Mr. Charles Kessler, Sr. T. B. Calcaño, Sr. Gerónimo Marquez, Sr. T. B. Marquez, Sr. Nicolas D. Delgado, Mr. Lebeau, and Sr. Romero, and two others.

The Company work the mine, and the net proceeds are divided thus:—two-thirds for the shareholders owning the working capital, and one-third for the proprietors of the mine.

The ores discovered lately yielded 12½ of silver and 1 of gold.

This mine is situated in the same range with the Gran Pobre silver lead and gold mine in Carupano, Venezuela, which for the abundance and richness of its ores was considered much better than the Rivilla Mine. To advance the mine has induced the owners to resolve that one of them should come to this country to form a Company to work the mines on a large scale.

MODE OF TREATMENT OF ORES OR ALLOYS OF GOLD AND SILVER.—BY M. A. PARKER.

These improvements, noticed on page 528, Vol. I., are here described in more detail. The original specifications having failed to come to hand, we have been obliged, at some disadvantage to the sense, to restore them from the French text:—

1st. Extraction of gold and silver from their ores or alloys by the sulphuret of iron, oxide of iron, and carbon.

This process is commenced by preparing the sulphuret of iron in the following manner:—Iron pyrites are put in fusion with lime, care being taken to skim off the silicious matter. It is then poured into water, when it is ready for use. In recommending the use of oxide of iron, it is meant either hematite or the oxide produced with the sulphuret of iron above described, reduced in powder, and calcined for about 20 hours, in order to drive off the sulphur as much as possible. As for carbon, the preference should be given to anthracite. To operate on silver ores containing from $\frac{3}{1000}$ to $\frac{15}{1000}$ of silver, to one ton of ore is added 440th of sulphuret of iron, prepared as above described, from 225 to 335 pounds of oxide of iron, and the same amount of carbon (anthracite).

The whole of these materials are to be intimately mixed, having been previously well pulverized. The mixture is then introduced into a reverberatory furnace, and kept in fusion during four or five hours. If the mass is pasty and difficult to fuse, 200 pounds of lime is added, and when in complete fusion it is allowed to flow into water. The scoriæ, generally sufficiently deprived of silver, are thrown away, but, if by analysis they are found to still contain a notable quantity of the metal, they are melted a second time, in adding the same quantities of sulphuret of iron and carbon as before. The regulus of silver, thus obtained, is crushed or ground by any suitable means into a fine state of division, and calcined during from twelve to twenty hours, treating it similarly to copper, in agitating it frequently. It is then taken out and mixed with finely pulverized carbon, in the proportion of from 175 to 225 pounds of carbon to one ton of the matter, and lime in the same proportion. It is then kept in fusion about two hours, and if after pouring, the product does not contain from 0.056 to 0.060 of silver, it is ground, remelted, and calcined again.

This matter is then taken and melted with lead, carbon and lime, and run into iron moulds.

The mixture of lead and silver thus obtained is ready to be treated in the furnace of cupellation in the usual manner. The mixture is composed of 110 pounds of carbon, as much of lime, both being finely pulverized, and from 225 to 325 pounds of oxide or sulphuret of lead. This will suffice to extract the silver from one ton of the regulus. In place of using lead as above described, and when the regulus is rich in silver, it may be ground

finely and calcined to drive off as much as possible the sulphur and arsenic, and melted in a reverberatory furnace with 220 pounds of carbon, and as much lime, which reduces the silver to the metallic state. It is then run into moulds, and taken to the cupellating furnace. Gold may be treated in the same manner and with the same proportions as have been indicated for silver.

2d. Separation of gold and silver from their ores or alloys by the use of sulphate of lime, or of baryta, and oxide of iron.

Melt together one ton of ore, from 300 to 400 pounds of one of the above sulphates, 220 pounds of carbon, the same quantity of oxide of iron, and a quantity of lime sufficient to render the mass fluid; the whole being first finely pulverized. The regulus obtained is ground, calcined, and melted in the same manner as in operating on silver by the preceding method.

3d. Reduction of silver from its ores by a simple fusion.

For this method, only very rich ores should be taken, and they should be very finely pulverized. The operation is commenced by calcining the ore to get rid as much as possible of the sulphur and arsenic, then it is mixed in the proportion, one ton of ore, 1300 pounds oxide of iron, 350 pounds carbon, and 225 pounds lime, the whole is fused during three or four hours, the silver is then run into moulds as before, and is afterward treated in the usual manner.

4th. Extraction of gold and silver by means of sulphurets, or arsenical alloys of nickel or of cobalt.

The ore is kept in fusion during three or four hours with the alloys of nickel or cobalt, in the proportion of five in volume of the former to fifteen of the latter, and adding for each ton 110 pounds of carbon and 225 of lime as flux, the whole being in fine powder. It is then run into moulds as usual.

The regulus thus obtained is ground and calcined to drive off the sulphur and arsenic, and the nickel or cobalt is finally dissolved out by hydrochloric acid. The metals are then treated in the usual manner, and are taken from the residue by fusion with fluxes.

COALS AND COLLIERIES.

ANTHRACITE COAL TRADE FOR 1853.

	Tons.
Shipments from Richmond to close of the week ending July 15th,	677,223
Same time last year,	518,286
Increase,	158,937
Amount sent by Reading Railroad to July 20th,	1,100,929 00
" Schuylkill Canal,	488,552 10
Total,	1,589,581 10
Same time last year,	1,211,471 05
Increase,	328,110 05
Lehigh coal shipments to July 15th,	468,930 11
Same time last year,	468,136 09
Decrease,	4,105 18

CUMBERLAND COAL TRADE.

Mount Savage Railroad to July 15th,	89,820
Cumberland Railroad, "	111,784 08
Westernport Region,	94,371 06
	295,975 14
To July 7th, 1853,	226,263

fields, and are among the most valuable portions of those fields. They include the continuous range of the large white ash veins for five miles along the south slope of the Locust Mountain; the entire coal basin between the Locust Mountain and the Coal Ridge for upwards of four miles in length; the entire coal basin between the Coal Ridge and the Red Ridge for an equal distance, and the north slope of the Red Ridge for about two miles—giving in all a run of about twenty-four miles upon the large white ash veins, accessible for mining above water level. The veins have been proved by shafts and workings at several points along this extended line, and give the most encouraging prospects of the abundance and quality of the coal. On the south side of the Locust Mountain, the principal vein has nowhere been proved less than twenty-four feet thick; and in one instance it has been cut across in an old working forty-seven feet. In the coal basins north of the Locust Mountain, five workable veins have been proved, one of which is from fifteen to twenty-two feet thick; another ten to eighteen feet, and the others from four to seven feet thick.

There are now under contract and approaching completion, three avenues to market for the coal from these lands, viz.:—The Mahanoy extension of the Minehill and Schuylkill Haven Railroad, which will reach all the collieries upon the Company's lands lying south of the Locust Mountain, and is now nearly ready for use; the Philadelphia and Sunbury Railroad, reaching the basins north of the Locust Mountain, also nearly completed; and the Coal Run Railroad, passing through the whole length of the Company's land, and opening the Shamokin coal basins to an eastern market, via the Catawissa and Little Schuylkill Railroads.

Five collieries of the largest class are now in progress upon the lands of the Company; four of which are in a forward state, and can easily be completed by the opening of the railroads being constructed to them, viz.:—

THE BIG MINE RUN COLLIERY,

Located on the south slope of the Locust Mountain, at the Gap made by the Big Mine Run. The breaker and shutes are up, and the machinery for hoisting, breaking, and preparing the coal, consisting of three twenty-horse engines, rollers, screens, gearing, etc., will soon be ready. The breaker has an elevation of one hundred feet above the railroad track, and a front of one hundred and forty feet. The gangway has been driven about one hundred yards (a portion of it double track) through solid coal. The vein opened here has about twenty-eight feet of superior coal. A very large amount of coal from the basin north of the Locust Mountain may also be brought to this breaker, by a short lateral railroad through the gap of the mountain.

There have been built in the immediate vicinity of this colliery, an excellent saw-mill, driven by the Mine Run, upon which the timber for improvements has been prepared; twenty-four miners' houses, eighteen of which are completed and occupied by the miners and laborers. Of the twenty-four, fourteen are frame, and ten stone buildings.

THE LOCUST RUN COLLIERY

Is located on the south side of the Locust Mountain, at Locust Run, one mile and an eighth west of the Big Mine Run Colliery. The veins here had been proved some years since, and one had been worked for several years for supplying coal to farmers and others in the Catawissa and Roaring Creek valleys. It was the lowest point at which some of the veins could be reached, and the shaftings and workings were deemed sufficiently encouraging to warrant the commencement of improvements. A tunnel of large size has been driven some eighty yards, and has gone through a vein of about ten feet of excellent coal. Another vein is expected to be reached in a few yards. Two veins have also been opened south of the mouth of the tunnel, upon which gangways can be driven.

LOCUST MOUNTAIN IRON AND COAL COMPANY.

The annual report of this Company was made to the stockholders on the 19th of June. It embraces the reports of the Directors and the Superintendent of the mining property. The railroads extending to the mines will be open successively during the summer. The applications for leases have been so numerous that the Company have declined to make further for the present. After noticing the various outlets to market, the Directors proceed to speak of the principal additions which have been made to their mining facilities, as follows:—

These consist partly in one hundred and fifty miners' houses, finished and in progress, constructed in blocks of two each. Their cost has been about five hundred and fifty dollars per block, or two hundred and seventy-five dollars per house. Also, a neat cottage, which was erected at Centreville for an office, and the future residence of the Company's agent.

A coal-breaker, with all other necessary improvements to ship coal, is now nearly completed, at an expense of about eighteen thousand dollars.

We are also driving three tunnels, viz.: one for George Repplier, on Locust Run; one for M. G. Heilner, on Big Run, (both on the south side of the Locust Mountain;) and one for Messrs. M. Bell & Co., on Red Ridge, near the western boundary of our estate. This latter colliery will connect with the Coal Run Railroad by a short lateral, about one mile in length.

Three coal-breakers, with all the necessary improvements, in addition to those erected by ourselves, are being built by our tenants, as follows, viz.:—Messrs. Bart & Pearson, on Mine Run; George Repplier, on Locust Run; and M. G. Heilner, on Big Run.

Since we commenced operations, your Board have expended ninety-three thousand three hundred and fifty-three dollars and forty cents, ($93,353.40,) all of which is paid. For further particulars in detail, the Board would refer you to the able Report of the Company's Agent, A. W. Rea, Esq., which will be appended to this report.

In conclusion, we congratulate our stockholders upon the near approach of that period from which we may confidently expect to date a cessation of expenditures only, and reasonably look forward to the commencement of a remuneration for the money, time, and labor that have to this time been expended in developing the hitherto unproductive riches of our property. With an estate of six thousand two hundred and fifty (6,250) acres, all of the best quality of coal lands, in the heart of the middle coal field, and so shaped as to make every part of it available for mining operations, together with the fact that the Company is *entirely free of indebtedness*, and is now about ready for a large production of the same to all the different markets, our stockholders must readily perceive that they respectively hold an interest of great intrinsic, as well as productive value.

The constantly increasing demand for anthracite coal, not only in the more densely populated sections of our Union, but even in those which yesterday were but wilderness, must banish all doubts from the minds of even the most skeptical, that we have embarked in an enterprise that cannot (so far as human prescience extends) fail to be highly remunerative, and confer its advantages alike upon him who buys and him who sells.

The following is the Report of the Agent to the President of the Company:—

MOUNT CARMEL, PA., *June* 8th, 1854.

Sir:—In compliance with your request, I submit the following statement of the improvements in progress upon the Company's property:—

The lands owned by the Company comprise some six thousand acres, lying entirely within the coal measures of the Shamokin and Mahanoy coal

fields, and are among the most valuable portions of those fields. They include the continuous range of the large white ash veins for five miles along the south slope of the Locust Mountain; the entire coal basin between the Locust Mountain and the Coal Ridge for upwards of four miles in length; the entire coal basin between the Coal Ridge and the Red Ridge for an equal distance, and the north slope of the Red Ridge for about two miles—giving in all a run of about twenty-four miles upon the large white ash veins, accessible for mining above water level. The veins have been proved by shafts and workings at several points along this extended line, and give the most encouraging prospects of the abundance and quality of the coal. On the south side of the Locust Mountain, the principal vein has nowhere been proved less than twenty-four feet thick; and in one instance it has been cut across in an old working forty-seven feet. In the coal basins north of the Locust Mountain, five workable veins have been proved, one of which is from fifteen to twenty-two feet thick; another ten to eighteen feet, and the others from four to seven feet thick.

There are now under contract and approaching completion, three avenues to market for the coal from these lands, viz.:—The Mahanoy extension of the Minehill and Schuylkill Haven Railroad, which will reach all the collieries upon the Company's lands lying south of the Locust Mountain, and is now nearly ready for use; the Philadelphia and Sunbury Railroad, reaching the basins north of the Locust Mountain, also nearly completed; and the Coal Run Railroad, passing through the whole length of the Company's land, and opening the Shamokin coal basins to an eastern market, via the Catawissa and Little Schuylkill Railroads.

Five collieries of the largest class are now in progress upon the lands of the Company; four of which are in a forward state, and can easily be completed by the opening of the railroads being constructed to them, viz.:—

THE BIG MINE RUN COLLIERY,

Located on the south slope of the Locust Mountain, at the Gap made by the Big Mine Run. The breaker and shutes are up, and the machinery for hoisting, breaking, and preparing the coal, consisting of three twenty-horse engines, rollers, screens, gearing, etc., will soon be ready. The breaker has an elevation of one hundred feet above the railroad track, and a front of one hundred and forty feet. The gangway has been driven about one hundred yards (a portion of it double track) through solid coal. The vein opened here has about twenty-eight feet of superior coal. A very large amount of coal from the basin north of the Locust Mountain may also be brought to this breaker, by a short lateral railroad through the gap of the mountain.

There have been built in the immediate vicinity of this colliery, an excellent saw-mill, driven by the Mine Run, upon which the timber for improvements has been prepared; twenty-four miners' houses, eighteen of which are completed and occupied by the miners and laborers. Of the twenty-four, fourteen are frame, and ten stone buildings.

THE LOCUST RUN COLLIERY

Is located on the south side of the Locust Mountain, at Locust Run, one mile and an eighth west of the Big Mine Run Colliery. The veins here had been proved some years since, and one had been worked for several years for supplying coal to farmers and others in the Catawissa and Roaring Creek valleys. It was the lowest point at which some of the veins could be reached, and the shaftings and workings were deemed sufficiently encouraging to warrant the commencement of improvements. A tunnel of large size has been driven some eighty yards, and has gone through a vein of about ten feet of excellent coal. Another vein is expected to be reached in a few yards. Two veins have also been opened south of the mouth of the tunnel, upon which gangways can be driven.

The breaker and shutes are in a forward state, and the machinery will soon be ready. A stone engine-house, boiler-house, and stack-house have been built; the drift road from the tunnel to the breaker is graded, and the work is done upon a considerable portion of the lateral railroad from the breaker to the main road. The colliery will be ready for shipping coal by the time this railroad is completed.

There have been built for the use of this colliery, twenty-four miners' houses, four of them in the immediate vicinity of the breaker, and twenty at Centreville; eighteen of the twenty-four are finished, and six yet to be plastered. There has also been built for the use of this colliery, and that at Big Run, a good steam saw-mill, upon which the timber for the two breakers has been mostly prepared.

THE BIG RUN COLLIERY

Is located one mile and three-quarters west of that at Locust Run, and upon the same range of veins. In the old working, near the centre turnpike, one of the veins of this colliery was found to be forty-seven feet thick. A tunnel was commenced at the Run, and has been driven some eighty-five yards. A vein of twenty-four feet of excellent coal has been passed through. A vein has been shafted of considerable size some distance farther north, to which it is intended to drive the tunnel. One or two veins can also be opened by gangways south of the tunnel. The breaker and shutes are up, and the machinery building. Twenty-four dwellings have been built for the use of the colliery, sixteen of which are finished, and eight yet to be plastered. This colliery can be completed by the latter part of the summer; but as the railroad to it will not be finished, no coal can be shipped from it this year. It is expected to be ready for the early opening of the coal business next spring.

The coal from the three collieries above mentioned, will reach the Schuylkill market by the Mahanoy extension of the Minehill and Schuylkill Haven Railroad, branches from which extend to each colliery.

THE COAL RIDGE COLLIERY

Is located at the point of Coal Ridge, in the Shamokin coal basin, and near the western limits of the Company's lands. The middle branch of the Shamokin cuts the axis of the ridge at this point, enabling us to drive gangways at once upon the north and south dipping veins. There are three veins now opened, upon which about five hundred yards of gangway have been driven. Each vein is from twelve to sixteen feet thick. The one on the south slope of the ridge is said to be among the oldest opened veins in the State—coal from it having been rafted on the Schuylkill to Philadelphia in 1803 or 1804 by Nicholas Allen, and a considerable quantity mined from it as early as 1815. The coal here is the hardest white ash, and well adapted for the various processes of manufacturing iron.

The colliery is nearly ready for shipping coal. The breaker, shutes, planes, rollers, engine, boilers, etc., are up; and the drift-roads and breaker-tracks mostly graded. The size of the veins seeming to warrant the introduction of the largest class of drift-cars, the gangway-tracks have all been laid to a guage of fifty-six inches, and the gangways timbered of a corresponding size. Some two hundred yards of railroad track from the south gangway to the breaker, and about five hundred yards for the main road and road under the shutes, have been graded. Thirty-two houses have been built, twenty-four of which are finished, and eight yet to be plastered. Eight of the dwellings are of stone.

THE RED RIDGE COLLIERY

Is located on the south slope of the Red Ridge, and about four hundred yards north-east of the Coal Ridge Colliery. The veins correspond in size and quality of coal with those opened on Coal Ridge. A tunnel, having an open cut of eighty yards, has been driven in and timbered about seventy-five

yards. Four veins were shafted upon the slope of the hill, neither of which has yet been reached by the tunnel. The colliery is not expected to be ready the present year. In driving through the slates overlying the coal veins, large quantities of iron ore have been found; some of the beds having it so abundantly as to encourage the hope of profitable working. Considerable deposits of bog ore also occur upon the surface in this vicinity. There have been commenced for this colliery thirty-two dwellings, eight of which are up, but none completed.

THE LOCUST MOUNTAIN COLLIERY

Is located a short distance south-west of the Coal Ridge Colliery, upon the veins of the north slope of the Locust Mountain. The veins have been recently proved preparatory to commencing a tunnel, and the prospect of a valuable and extensive colliery is quite flattering. One has eighteen and another fifteen feet of excellent coal.

These three collieries will have an outlet to Susquehanna by the Philadelphia and Sunbury Railroad; and to the eastern market by the Coal Run Railroad, now building, to intersect the Catawissa and Little Schuylkill Railroads.

In addition to the above collieries upon the lands of the Company, shaftings have been commenced to prove the veins farther eastward in the basins north of the Locust Mountain, and to ascertain the most eligible points for the location of other collieries. In the southern basin, near the eastern limits of the Company's lands, a vein has been proved twenty-two feet thick; and near the eastern end of the northern basin a large vein had been worked for many years. It is expected that collieries, possessing advantages equal to those already started, can be located in these basins.

Besides the improvements in building and opening collieries upon their lands, the Company has been at considerable expense in making and opening roads for the accommodation of the population, now rapidly settling upon them, and for public use. A road of some six miles in length, extending from Mount Carmel to Big Mine Run Colliery, through the valley of the south branch of the Shamokin and the Gap of the Big Mine Run, has been made by the Company, and another of two miles, along the south slope of the Locust Mountain, from the State road to the Big Run Colliery, with several shorter roads to the collieries and buildings.

Deeming it a matter of importance to provide comfortable homes for their miners and laborers, all the houses built by the Company have been large and roomy, and finished in a better style than has been usual in the coal region. There have been built and commenced within the past year, one hundred and fifty dwellings of this class, upon the Company's property. The old stone tavern on the State road has been entirely remodelled and rebuilt, and a considerable addition built to it. The frame tavern at Centreville has also been considerably improved, and the sale of liquors discontinued in both. There are now no liquors sold upon the Company's property.

Yours, truly,

ALEX. W. REA, *Agent.*

J. ANSPACH, JUN., ESQ.,
President Locust Mountain Coal and Iron Company.

PROFITS OF COAL LANDS.

The profits received by the owners of coal land where coal is mined and sent to such a market as is at present found on the Atlantic coast, are such as to astonish those who are not familiar with the facts. The annexed statements in the *Record of the Times*, drawn from the reports of that most successful Company, the "Delaware and Hudson Canal," furnish an instance

of profits perhaps of the highest scale. They are worthy of consideration:—

Doubts having been expressed whether statements made in your paper of the profits in coal lands in Luzerne were correct, from the fact that they seemed too enormous to be true, I send from an official statement the profits of the Delaware and Hudson Canal Company. To the question, "What amount of moneys have been divided among the stockholders in the form of dividends," &c., I copy the answer for five years:—

1846, per cent. 16	$445,904
1847, per cent. 20	576,600
1848, per cent. 18	661,162
1849, per cent. 16	730,360
1850, per cent. 14	809,248
	$3,223,274

Three millions in five years.

But how happens it that in 1850, with a per cent. of only 14, they divided $809,248, whereas in the previous year, with a per cent. of 16, they only divided $730,360? Is it not a loose statement? Mere guess work? Accurate, sirs, to a penny! They had doubled their capital! But the half is scarcely told. The Company had immense surpluses—in fact, so much money they hardly knew what to do with it. Taking the 14 years from 1837 to 1850, the surpluses, after paying the expenses and dividends, (I speak from the book,) amounted to $3,225,932.

Surplus of 13 years, ...	$3,525,392
Dividend in 5 years, ...	3,223,274
	$6,449,206

In the mean time, please to observe, the Company, with a sagacity and energy rarely surpassed, were laying out very large sums to improve their canal, so that boats, instead of taking 30 tons, carry (at half the cost a ton) 100 tons, and those sums were paid out of the profits, of course, and charged as expenses.

Again, their stock in market was from 30 to 40 per cent. above par. So they doubled their capital, dividing mainly the new stock among themselves, at par. A capital move; "it all brought fish to the coalman's net." They knew what they were about. They were bold, yet prudent; economical, yet liberal and just. Can another Company, or two or three more Companies, accomplish as much? Can there be a rational doubt, if the business is as well and honorably conducted; for will not the demand for coal in the north and west lake country be unlimited?

In 1847—we choose to go back when coal was low—in 1847 the Hudson and Delaware Company made a dividend of 20 per cent.		$276,600
And that year they had a surplus of		252,280
		$828,800
All their expenses were paid, interest on loans, liberal salaries, digging coal, &c., &c. Well, how much coal did they send to market that year? 838,200 tons. That year how stood capital? Ans.		$3,544,000
Interest at 7 per cent., ...		$269,080
Deduct the interest from the profits, and you have the net product of the coal.	$828,880 269,080	
	838,200)559,800	$1.65 a ton.
Now cipher for yourselves, what was the clear profit on each ton of coal?	838,200	

221,6000
202,9200

18,68000
16,91000

1,77000

The common 14-feet vein will yield, deducting pillars, waste, slate, net 15,000 tons to the acre; then each one will yield a clear profit of 15,000 × 165 = $24,750.

VIRGINIA COAL FIELDS.

Comparatively little is at present known of the vast internal resources of Virginia; this is particularly the case with reference to the south-western part of the State. A correspondent, who well understands the subject, writing to us in relation to western Virginia, uses the following emphatic language:—"Observe what will soon be transpiring in regard to the mineral wealth of south-western Virginia, heretofore a *terra incognita* to miners and capitalists. The iron is found there from which the government cannon are made at our Richmond Tredagar Works. The gypsum of this region is superior in quality to that of Nova Scotia. The salt brine found there is super-saturated, and perfectly free from impurities, making salt as white as the marble of Pentelicus. The lead of Wythe county, adjoining Smythe, is of the best quality in the United States, and is shipped in quite considerable quantities, considering the heretofore inaccessibility of the country to the Northern cities. The newspapers of this region are now filled with accounts of new and extensive discoveries of copper, some of the ores containing seventy-five per cent. of pure metal. Coal, semi-bituminous and anthracite, abounds there, and is already mined successfully. Withal, the country is one of the most fertile, prolific and beautiful regions your eyes ever beheld, and the climate the most delightful in the world."

A writer who has visited portions of Hampshire and Hardy counties in the same State, thus speaks of their coal fields:—

Having just returned from the short though interesting tour through the mineral regions of the north-western part of Hampshire, and the north-eastern part of Hardy counties, Virginia, I am surprised at the immense undeveloped mineral wealth of these two counties. It is great beyond anything I could have conceived. Indeed in the tracing of this secondary formation I have at times been much puzzled in its varied presentations. We meet with so many obstructions or barriers that seem insurmountable, and indeed, from surface indications, would lead the most wary astray. These obstructions or faults are produced from various causes, attributable to slides, breaks, washes, &c., and only to be reached by excavation. Sometimes nature develops, but these developments almost always occur where there have been faults, and displace much of the original; and this can only be traced by disjointure of the strata and laminæ, also by a difference of organic remains in successive layers. These features are traceable here, at almost every point.

I find the rich deposits of mineral occupying universally the same position, and their form synonymous throughout the country, scarcely varying a point except where there are visible actions of the elements; and the only instance I have met with was in the eastern part of Hampshire county; and there we see the variation of their axis only two points therefrom, diverging north-east by east, per compass; making no allowance for the variations of

the compass. This frequently occurs from local attractions. I have known it to vary as much as 15 deg. 7 min. east.

I find at this point great exertions being made to develop the great coal and iron fields here met with—and know of no section of country that must in time form so great a field for operations as this.

MISSOURI COAL.

The summary particulars contained in the subjoined extract are interesting as relating to the supply of coal in Missouri:—

Although the city of St. Louis rests upon carboniferous limestone, no workable beds of coal have yet been found in its vicinity. The coal which is consumed in the city is brought mostly from the opposite side of the river, in Illinois, about nine miles distant. The first beds of coal of much importance along the Missouri are those of the Osage cannel coal, which occur in several localities between Rockport and the mouth of the Osage River, one hundred and sixty-three miles above St. Louis. These beds are very remarkable, and the important influence they are expected to have on the manufacture of iron will render them of much interest to all. Dr. D. D. Owen, in his admirable report says:—

"It is between Rockport and the mouth of the Osage, on both sides of the Missouri River, that those immense beds of coal are found, which attain a thickness of twenty, perhaps forty feet. The Osage coal is remarkable not alone for its extraordinary thickness, but also for the peculiar character and structure of the coal itself, together with the mineral insinuations which invade it. The lightness of this combustible is such that before imbibing water it will float upon that fluid, indicating a specific gravity actually less than 1. In its structure, fracture, and lustre it has an appearance intermediate between cannel coal and the dull varieties of asphaltum, but it contains 31 per cent. less volatile gases than pure bitumen, and from 5 to 10 per cent. more volatile matter than the ordinary varieties of the bituminous coal of the western coal fields.

"At the pit west of Marion this coal assumes a cuboidal, and even a subcolumn or structure, somewhat analogous in miniature to basaltic trap, while at the same time a network of pyritiferous ores of zinc and iron have ramified its joints and fissures, and appear often in brilliant crystalline forms—the whole bearing evidence of great local disturbance, igneous action, and gradual consolidation under pressure. It appears, indeed, altogether probable, from the peculiar character of the coal, its structure, and great local thickness, that it has been subjected to a sufficient degree of heat to have fused or semi-fused the mass, under a pressure that prevented the escape of the volatile gases, transferring it, at the same time, either in this condition or by sublimation, from its original bed into some wide adjacent fissure formed by disruption of the strata, where it has then very gradually passed into the solid state. Its uniform occurrence in close proximity to an abrupt change in the geological formation of the adjacent country, and the sudden elevation of primitive rocks, together with the highly inclined position of the coal itself, furnishes abundant proof that it has been implicated in the remarkable disturbances which have convulsed the whole of the surrounding country subsequent to the carboniferous era."

At Lexington a bed of coal is found two feet in thickness, and rests on an indurated clay. It is workable to a considerable extent, and finds a ready sale to the steamboats on the river.

The best bed of coal that will probably be found of any value on the river, occurs at Wellington, 365 miles above St. Louis. This is from twelve to fourteen inches in thickness, and lies just above the bed of the river. It is, however, not very valuable, and supplies coal to a limited extent.

In no case have I observed any of those remarkable vegetable impressions

which are so common in many of the western coal fields. In Ohio and Kentucky, &c., in the shale lying above the coal are found beautiful impressions of ferns, cones, nuts, and a great variety of plants peculiar to the coal formation, which have become of the highest interest to the botanist. I have examined quite carefully in many places along the river, and in no case have I observed these remains.

PICTOU (NOVA SCOTIA) COAL.

Accounts from Pictou to July 14, state that the facilities for shipping coal had increased daily to about 900 chaldrons. Vessels were loading more rapidly. There were twenty American vessels in port.

SHEFFIELD (ILLINOIS) COAL.

We have in our office a specimen of coal from Sheffield, on the Chicago and Rock Island road, taken from a barrel of the same, sent here for trial by the agent of the Company. This coal has been tested by one of our blacksmiths, and he pronounces it superior to any that he has yet worked from any other part of the State; he says if the specimen sent up is a fair sample, that it is but little, if any, inferior to the best Pittsburg coal, and that it will supersede the necessity of importing coal from the Ohio, as we are now compelled to do. Should the enterprising owners of this mine extend a branch of their road to this point, so that a full supply of this valuable fuel can be procured, at reasonable rates, we do not doubt that a demand and consumption will be created in our vicinity, far exceeding their most sanguine expectations.—*Galena Jeffersonian.*

BURNING COKE.

The failure of the Parker Vein Company has suspended certain very interesting experiments in a new process of burning coke. A short time since, M. Guillaume Lambert, agent of the Belgian government, visited the Cumberland region, and induced the Parker Vein Company to try his improvement in coke ovens. The ovens were constructed at Barrelville; but the explosion of the Company has prevented a fair trial of their efficiency. M. Lambert's invention consists in constructing the ovens two by two, so that the smoke and gaseous products generated in one of the earlier stages of the coking process may be burned in the other which was charged earlier, and in which the coking has progressed to a more advanced stage, and may deposit therein a portion of their carbon. Thus the incombustible products, by passing in contact with the exterior of the oven in which the process is least advanced, serve to assist in heating the charge and setting free the gases. Another part of the invention consists in certain means by which each or any one of a long range of ovens may be discharged of its contents at once.

UNLOADING CANAL BOATS.

A method for unloading canal boats at Alexandria and Georgetown, where there is a fall of thirty feet between the canal and the river, has been patented by Mr. William Loughridge, of Weverton, Md. A canal boat with valves in the bottom is floated into a side dock and located directly over corresponding valves in the floor of the dock. The water is then drawn off, the boat settles, the valves are opened, and the coal passes out entirely through shutes into cars beneath within a few minutes.

IMPROVED COLLIERY VENTILATION.

In the *Journal* of the 18th of May we noticed an improved system of ventilation in collieries, suggested by Mr. R. Williamson, of Kennington-road, which is every evening described by Mr. Johns, the lecturer on mechanics at the Polytechnic Institution, and attracts considerable attention. We have received a paper on the subject from Mr. Williamson, which is further descriptive of the proposed system, for the entire of which we cannot find space, but proceed to explain some of the principal details. In adopting this plan, the main downcast air-way is made the main upcast, the roadway nearest the workings being the main downcast, the air passages overhead crossing the latter draw the foul air from the goaf to the upcast air-way, the effect of which is to cause a current of air to pass up each of the branch roadways which are left open to the coal face, from whence it is drawn into the goaf in the same proportion as the gas is extracted from the waste by the ventilator, which may be either a steam-jet, a furnace, or a fan, as circumstances may dictate. By this plan the upcast air-way is an extension of the upcast shaft, drawing the foul air from every goaf or separate part of the mine, independent of each other, the quantity being regulated by the size of the opening of the overhead air-way, the area of the whole of which must not exceed the area of the upcast shaft. The advantages claimed for this plan by the inventor are—that in case of a blower, the workmen can be withdrawn until it has exhausted itself, without causing injury to any other part of the mine; that the gas would be drawn away from the lamps, thus preventing its diffusion with the air at the coal face, for although the gases diffuse themselves somewhat rapidly, there is the difference of specific gravity to overcome, by which the probability of an explosion would be lessened; that on the fall of the barometer and change of atmospheric pressure, when the gas in the goaves expands, the increased volume would escape by the upcast air-ways, instead of being driven into the workings, as it is by the ordinary plan: that even in the event of an explosion it would be entirely local in its effects, as the after-damp would not pass through the workings, but through the goaf to the upcast. The ventilation would not be disarranged as it now is by the blowing down of traps and stoppings, which too often prevents any succor being given to those who, by an explosion, are prevented from obtaining fresh air or the means of exit. In working the mine greater facilities are offered than in the old plans, as well as economy secured from the diminished number of traps, offering opportunities for the children's education instead of being employed at a tender age in the mines. A large proportion of the foul air will be drawn off by the openings being made in the upper parts of the workings, giving the carburetted hydrogen the advantage of its lower specific gravity to escape. By the circulation of air in the goaf, the spontaneous combustion of the small coal, abounding with iron pyrites, a case of frequent occurrence, will be prevented. It is possible that the free passage of the air through the goaf may be impeded by the falling of the roof of the mine, in which case one of the branch roadways must be trapped and made an upcast air-way, the necessary communication being made overhead with the main upcast windway. The old pillar workings, so general in the Newcastle district, may be advantageously altered to this plan, and every portion of the mine being drained, independently of any other part, and the plan will adopt itself to every contingency, whether the object is to work the whole coal in each part of the mine, before removing the pillars of coal, or to work whole coal and pillars at the same time. It is believed that the adoption of this plan will place colliery workings on a more sound and secure basis, and be the means of preventing the destruction of much property, and securing the safety of hundreds of valuable lives.—*London M. Journal.*

COAL IN TURKEY.

The Heraclea coal-field, which is situated about midway between the

Bosphorus and Sinope, commences about 7 miles north-east of Heraclea, and extends along the coast a distance of 60 miles to Anasserah. Its extension inland has not hitherto been accurately defined. Geologically speaking, it pertains to the true carboniferous formation. No stratum of an order superior to the coal measures is anywhere discernible, but throughout it is much interrupted and displaced by the intrusion of other inferior strata belonging to the Devonian group. It is consequently much divided, and now appears in the form of a succession of small fields, which are doubtless the remains of what was originally one continuous deposit. These seams are, moreover, again intersected by faults (dislocations of the strata); but it is observable that no effects of direct volcanic action, such as the intrusion of basaltic dykes, have been hitherto recognized. This is the more noticeable from the fact that tracytic conglomerate abounds in the immediate neighborhood, at Heraclea and elsewhere. The inclination of the coal-beds is strangely irregular, ranging through every intermediate angle between the horizontal and the vertical. The configuration of the country is that of mountain ridges (from 1,500 to 2,000 feet high), separated by narrow valleys of seldom more than a few hundred yards in width, which terminate on the sea-shore. The coal-seams are found cropping out upon the sides of these mountain ridges throughout the district. About 17 years ago the deposit was first discovered, or publicly made known. Since then, with the exception of the coal lying in the neighborhood of the Coslou Valley, it has been worked by Croats, Montenegrins, Bosnians, and other workmen drawn from among the quarrymen in the neighborhood of Constantinople. These persons work the "outcrop," or edge of the coal-seams where they appear on the mountain sides, and are supplied by the Government orders with laborers from the adjoining villages, who bear the coal in baskets from the mines to the surface. They are paid alike for coal worked from seams good, bad, and indifferent; and consequently work all equally abundantly; while their want of all capital, and their utter ignorance of mining knowledge, enforce a system of working which inflicts great and permanent injury on the district. Numerous seams have been already entirely worked out and abandoned by these persons at from 100 to 150 yards into the mountains; and it consequently results that, should future works be undertaken, a considerable expense, in the absence of any records, will have to be incurred before even a knowledge of the quality can be ascertained. In the course of a few years (five or six) the whole district will be similarly abandoned. The coal thus worked amounts to about 35,000 tons annually, and is conveyed to the shore on mules, whence it is transported during the summer months to Constantinople. A small quantity is boated round from the mouths of the different valleys to Heraclea, in order to supply the casual wants of any steamers that may call; but no shipments to any considerable extent take place from that port. In one valley, that of Coslou, 18 miles north-east of Heraclea, works on an improved system have been adopted during the last three years, and the management entrusted to English engineers, assisted by a small staff of European workmen. The usual underground appurtenances of such works have been introduced, and thus seams abandoned formerly by the Croats have been recovered, and rendered profitably available. The coal is transported to the shipping spouts on a tram railway, and is thence boated off to ships lying in the roadstead. From 400 to 500 tons can be thus shipped daily. The mines situated in this valley were lately visited by her Majesty's steamer Spitfire, Commander Spratt, and a survey made of the roadstead and port of Heraclea. Good holding-ground was found in both places, while, in addition, the latter affords a secure shelter for any steamers on the coast. The stock of coal at Coslou now on hand is about 9,000 tons, and an additional quantity of 2,500 tons per month can be extracted. The object of the Spitfire's visit was to inquire as to the quantity disposable, and to test the quality of the coal for steam purposes. It is understood that the

trial proved very satisfactory. The coal varies from the Newcastle in being more friable, and in producing from 1 to 2 per cent. less ash and clinker; in other respects it is undistinguishable. It evaporates the same quantity of water, is of the same specific gravity, and is equally gaseous. The fracture is cubical, and discloses the calcareous laminæ, or facings, such as are observable in the Newcastle coal, and which are supposed in that district to pertain solely to the best seams. Since the return of the *Spitfire* an application has been made on behalf of the English and French Governments for a monthly supply of this coal to the Anglo-French fleet. It is, moreover, hoped that arrangements will be made whereby the production of the mines may be increased, and some of the abuses which now exist there, in common with all other public works in this country, curtailed, or possibly abolished.—*London Mining Journal.*

IRON AND ZINC.

COST OF PRODUCING IRON IN SCOTLAND COMPARED WITH THAT IN SILESIA, AND THE MOST IMPROVED SYSTEM OF CHARCOAL SMELTING ON THE CONTINENT.

One of the chief barriers to the introduction of free trade, or at least of a greater approach to it, in France and Germany, has been the fear of destroying the iron trade of those countries, which is very considerable—that of France having been, in 1846, 522,000 tons and being now perhaps not far from 1,000,000 tons; while that of Prussia, in 1851, was 348,000 tons. As it is not probable that so important a branch of industry will be sacrificed in either country, the only way in which free trade can arrive will be by removing the necessity for protection—that is, by introducing such improvements into the manufacture as will lower the cost of production to the standard of Great Britain. The following facts may help to show whether such is possible or not: —

According to the *Mining Journal*, No. 821, p. 237, for 1851, the average cost of producing 1 ton of common Scotch pig-iron in that year was—

	£	s.	d.
32 cwts. of calcined ironstone (black or clay-band), and containing 62.5 per cent. of iron, at 12s. per ton.	0	19	2
45 cwts. of coal, at 4s. per ton	0	9	0
16 cwts. of cinders, at 1s. 6d. per ton	0	1	8
7 cwts. of limestone, at 8s. 6d. per ton	0	1	8
Labor at the smelting-works	0	3	8
Sundries, inclusive of horses	0	2	0
Interest upon capital (20,000*l.* for a furnace, inclusive of all other outlay at the smelting-works and mine)	0	3	4
Total.	£1	19	8

According to Mr. Eck, Inspector of Smeltings-works in Silesia, and Mr. Chuchul, machinist, the average cost of producing 1 ton of iron in Scotland, as calculated from the average cost of the raw materials employed at the chief works, is as follows: —

	£	s.	d.
35 cwts. of calcined ironstone (blackband, supposed on an average, to contain 57 per cent. of iron), at 10s. per ton	0	17	6
2 tons 5 cwts. of splint coal, at 3s. 8d. per ton	0	8	3
10 cwts. of limestone, at 4s. 6d. per ton.	0	2	3
Three quarters of small coal, at 1s. 6d	0	1	1½
Labor at the furnace	0	1	0
Interest upon capital, wear and tear of furnaces and blast apparatus, and sundry expenses, usually reckoned in Scotland at 6s. per ton,	0	6	0
Total cost of 1 ton of Scotch pig-iron,	£1	16	1½

In many of the German iron-works, from the smallness of the furnaces, the superior quality of the iron, which fetches a much higher price than the commoner kinds of British, and especially Scotch iron, joined with a considerable protection, the economy of working was not, up to a late period, carried to the same extent as in France, and now to a considerable extent in Great Britain. The average cost of production in Germany of coke pig-iron approximates very closely to that established with great care at the furnaces of the Konigshutte, in Upper Silesia, and which may be thus stated: —

Ore,	£1	0	8½
Coal,	1	1	8½
Lime,	0	1	10 4-5
Small coals,	0	5	2½
Wages,	0	3	1½
Wear and tear, management, interest upon capital, etc.,	0	11	10½
Total,	£3	4	6

Silesian iron would thus appear to cost, according to the first of the preceding estimates, 1*l.* 5s. 3d. more than Scotch iron, or 1*l.* 8s. 4½d. according to the second, or 64 per cent. and 78 per cent. respectively. In the Scotch estimates, the coal is reckoned at cost price at the mines, the latter being supposed the property of the proprieter of the iron-works; whilst in the German, on the other hand, the coal is calculated at the usual selling price. By allowing for this difference, the German estimate will be reduced to the extent of 10s. 10d.—that is, 1 ton of pig-iron will cost in Silesia 2*l.* 13s. 8d½., or 14s. 5d. more than Scotch pig, according to the first estimate, and 17s. 6½. according to the second, or 36 per cent. and 48 per cent. respectively. A considerable reduction could be effected in the item of management, which, according to the preceding estimates, is nearly double as much in Silesia as in Scotland, if the trade increased so as to enable the works to be increased. The iron-works of the latter have generally twice, and sometimes four times, as many furnaces as those in the former, and each of these is also generally capable of producing perhaps four times as much iron: hence the greater expense under the head of mangement in Silesia. Several other improvements may also be introduced so as to lower the expenses of working, such as an improved method of removing the cinder, the substitution of machinery for hand labor in lifting the ore to the top of the furnaces (a method which is very generally practised with small furnaces), the better economising of the waste gases, &c. Another item to be also taken into account is the superior quality of the German iron, and the greater loss sustained in remelting Scotch pigs, from the adhering coarse moulding sand. Summing up all the deductions which may be thus made, it is probable that iron can be produced with coke in the coal districts of Germany, and in certain of those of France, for 2*l.* 10s.; but it is very improbable that it can ever be made as cheap as in Scotland, from the co-existence of certain circumstances there which scarcely exist anywhere else. Iron cannot, however, be made in other parts of Great Britain as cheaply as in Scotland; and it is probable that the average cost of producing 1 ton of pig-iron of the same quality is fully as high, if not higher, in England than what we have just set down as the minimum cost in Germany. From these calculations, it would appear that German, and we may add French, coke-made iron will very soon be in a position to compete upon equal terms with that of Great Britain.

Let us now see how the case stands with regard to charcoal iron. Instead of giving the results obtained at any particular iron-works, we shall quote the opinion of perhaps the best authority in Europe upon the subject, M. Leplay. From the most elaborate calculations, founded upon the present working of iron in Styria* and Carinthia, he has come to the conclusion, that

* For many particulars respecting Styrian iron, see the article in preceding pages of this number on "The product of the mines of Austria," &c., &c.

by a proper cultivation of the forest, which should be in the hands of the ironmaster, the economical production of the charcoal, and the most improved system of smelting, &c., the cost of producing 1 ton of charcoal pig-iron would not be more than 2*l.* 18½*s.*, as is seen from the following statement:—

50 cwts. of ironstone, at 8*s.* 4½*d.* per ton,	£1	0	11½
5 cwts. of flux (limestone), at 2*s.* 4½*d.* per ton,	0	0	7½
28 cwts. of charcoal, at 19*s.* 2½*d.* per ton,	1	8	1
Wages, calculated upon the basis of a weekly production of 271 cwts. of pig-iron,	0	1	9½
General expenses—management, wear and tear, rent, sundries, etc.,	0	8	5
Interest upon capital, including land, at 10 per cent. upon 27,750*l.*	0	4	5½
Cost of 1 ton of charcoal pig-iron,	£2	18	3½

This scarcely exceeds the average cost of producing 1 ton of superior coke iron in England, notwithstanding the cheapness of fuel, and the other unexampled advantages, as an iron producing country, which Great Britain enjoys. There is, therefore, sufficient margin left for improvement to enable the continental ironmaster to produce iron, whether with coke or with charcoal, at a cost sufficiently low to compete unprotected with British iron.

The same observations apply with equal force to the manufacture of bar-iron from charcoal pig-iron; according to Leplay, the following table may be considered to represent the cost of making 1 ton of charcoal bar-iron, if the manufacture be carried on upon the best principles:—

25·19 cwts. of charcoal pig-iron, at 2*s.* 11*d.* per cwt.,	£3	13	5½
49·8 cwts. of dried wood, at 7*s.* 2½*d.* per ton,	0	17	11½
Wages,	0	9	0½
General expenses—management, wear and tear, etc.,	0	14	5½
Interest upon working capital, and capital sunk in forest land, at 10 per cent. on 66,000*l.*	0	14	5½
Cost of 1 ton of charcoal bar-iron,	£6	9	8½

Or, if we deduct the sum allowed for interest upon capital, the cost of producing 1 ton of charcoal bar-iron would be 5*l.* 14*s.* 10½*d.*, a sum below which the price of English bar-iron has hitherto rarely sunk, and to which it will scarcely again fall, with the increased price of fuel in every part of Great Britain.—*Journal of Industrial Progress.*

CRESCENT IRON WORKS.

These works, located at Wheeling, in Virginia, belong to a Company incorporated by the Legislature of Virginia, who are now enlarging their capital for the purpose of carrying on a more extensive business. The following particulars relate to the property of the Company and their preparations for the manufacture of iron for useful purposes:—

The Company owns and places as part of the stock under the charter, large tracts of ore land in Monongalia and Marion counties, Virginia, within seventy miles of Wheeling, and near the Baltimore and Ohio railroad and the Monongahela river. This land abounds in ore of the best quality, and of sufficient quantity to last for centuries to come. It yields forty-five per centage of iron, is a four feet vein, and is in the same hills and together

The Styrian iron as well as that of Carinthia, which was known among the Romans by the name of "Novice iron," is in generally placed for its excellence on a par with that of Sweden.

with a bituminous coal vein of seven feet thickness, and plenty of lime and sandstone, together with an abundance of timber and wood. They have now one furnace in operation that will yield some eight or ten tons per day, and they desire to erect with the additional stock, two or three additional furnaces. The iron from these furnaces is brought to Wheeling at a cost of less than two dollars per ton, including wagoning, loading, railroad expenses, etc.

We will not state the cost of the manufacture of pig-iron at these works, for persons manufacturing and quantities made may vary the cost materially. We will only state a few facts. The ore is delivered at the furnace at fifty cents a ton cost, labor is cheap, for the country is alike healthy, and productive; and land and produce as cheap as in any other part of the country. There is everything here combined to produce as cheap labor as at any other place in the country. In addition to these advantages, the following facts show that in the simple item of cost of coal there is money to be made in this stock, as compared with eastern works. It requires six tons of coal to make, from the ore, a ton, say, of rails. This coal cost in the most favored localities east four dollars per ton $24
Coal at these furnaces and at the Crescent Mills in Wheeling, costs less than one dollar per ton 6

Saved $18

This is the saving made here in the item of coal alone for the manufacture of one ton of rails from the ore. Then for the supply of all western roads there is a saving in freight of five dollars per ton, giving these works, in those two items, a saving, all else being equal, of twenty-three dollars per ton. The iron from the works has been in use and is thoroughly tested, and found the best of iron, and the coal to be free from sulphur.

These works are peculiarly situated for economy and facility of operation, and we will describe them for the benefit of those who have not seen them. Wheeling creek passes into the river through the heart of the city, and through the gorge in the hills that line the margin of the Ohio, and cause that picturesque beauty that gave the river its title of *La Belle*. The Crescent Mills are situated on the south side of this creek, about six hundred yards from its mouth, where what is called Chapline's hill originally came down almost to the creek, and the road around it has been formed by taking out the rock for the building and the dirt and stone from the stripping the quarry. The works are so situated in the city that the dwellings of the hands are hard by; they are on a hard and level street, to the river but six hundred yards distant; they are on the bank of the creek, so that the sewers, which are large and of stone, take off the ashes and refuse without expense or labor, the refuse of mill adds daily to the ground, instead of involving cost to carry it away; the creek affords the means of transit of ore and iron by barges from and to the railroad and stamboats, in the cheapest manner possible. The Baltimore and Ohio and Hempfield railroad depots are within the six hundred yards distance, while the mouth of the coal bank in our best coal vein of six and a half feet of bituminous coal is not more than fifty feet from the works, and about thirty feet above the level of the ground.

The building for the works is one hundred feet wide and four hundred feet long, and from the eastern end, elevated to a level with the coal bank, is extended a railroad track, on which coal is run in cars, and let down, without handling, by the side of each furnace. There are thirty-six puddling and fourteen heating furnaces at work. Three trains of muck rolls, two of Burden's patent coffee mill squeezers, one train of sheet rolls, of boiler iron rolls, one of bottom and top rolls, and one full train of rail rolls with saws, punches, and all the necessary fixtures to make the mill complete for making rails in the most improved manner, the proprietors having availed themselves of all

the improvements in other mills, and their works will compare favorably with the best mills in this or any other country. The machinery is driven by two engines of great power, and will turn out 15,000 tons of the best iron per year.

NEW JERSEY ZINC COMPANY.

The report of the New Jersey Zinc Company, upon the progress of their works, for the six months ending June 1st, presents the annexed particulars:—

The result has been 1,345 tons of dry white oxide, 96 $\frac{9}{16}$ tons of dry brown, of which there were ground in oil, 751 $\frac{1}{2}$ tons white, 65 $\frac{3}{4}$ tons brown, and 59 $\frac{1}{2}$ tons stone color. There were also made 3,245 gallons varnish and 2,115 gallons zinc dryer. The total cash value of the product of the six months is $197,000. This production falls one-fourth below the quantity which at the time of the last report it was confidently supposed could readily be sold, and at the rate of which the works of the Company were then regularly producing.

Notwithstanding a reduction of one half-cent per pound in the white oxide, the demand did not equal the production. The expenses for oil, labor, etc., has been largely increased.

The causes above referred to have diminished the Company's profits during the past six months; still, with all this, the report says there were actually earned over 4 per cent. on the entire capital.

An experimental furnace has been erected at the works at Newark, for the purpose of determining on the spot the practical value of the large masses of residuum that have been and are daily accumulating.

On reviewing the operations of the past six months, says the report, it is evident that, notwithstanding the adverse circumstances that have tended to diminish the profits for that period, the business of the Company is now established upon a solid footing, with fair prospects of liberal extension and compensating fruits. A prudent policy, however, may dictate the withholding of these for a while longer from the stockholders, for the purpose of having them accumulate as a working capital, which is much needed by the business of the Company, and for which the reserved stock is in constant requisition. The Company hold 12,611 shares of their stock, being more than one-eighth of their entire capital. The actual production of the six months was 2,974,104 pounds.

STATEMENT OF THE OPERATIONS OF THE NEW JERSEY ZINC COMPANY DURING THE SIX MONTHS ENDING JUNE 1ST, 1854.

ASSETS.

Cash and bills receivable,	$15,317.43	
Outstanding bills as cash this day,	51,467.70	
Cash value of paints and oxide on hand,	93,978.42	
Cost price of ore on hand,	23,028.00	
Value of residuum,	25,000.00	
Cost price of coal on hand,	5,992.60	
Cost price of oil, gum, kegs, etc., etc.,	10,103.11	
		$234,881.26

LIABILITIES.

Due Agents for advances,	$75,737.20	
Bills payable,	89,197.96	
Salaries, etc.,	5,033.89	
		169,969.05
Balance,		$64,912.21
There have been expended of the earnings of the Company during the six months for additional machinery, houses and other permanent improvements,		18,201.80

In addition to the above, the Company hold 12,611 shares of their own stock, being more than one-eighth of their entire capital, upon which there is a loan of $27,822.89.

IMPROVEMENT IN ROLLING RAILROAD BARS.

Mr. William Harris, late of the Rolling Mill firm of Harris, Burnish and Company, of Pottsville, Penn., has just completed an invention for the manufacture of railroad iron, which in the opinion of our ablest mechanics is likely to give a fresh impetus to the iron manufacture, and to effect corresponding changes throughout the entire trade. It consists in a new method of arranging the rolls, and cannot fail, wherever understood, to entirely supplant the old process.

By the old (present) plan, each pair of rolls has nine separate grooves, through which the heated mass from the furnace is successively passed, until it is delivered from the last in the shape of a railroad bar. Much manual labor is required; and even with the most skillful and expeditious workmen, the metal has time to cool very considerably before it is finished, thereby becoming less malleable, and causing a dangerous strain upon the machinery. The breaking of a roll in such a mill, it is well known, is but a common occurrence.

Now, instead of the one set of rolls, containing the nine grooves; by the *new* process, there are nine separate pairs of rolls, each having but one groove—arranged in one continuous line, with close ducts or boxes between; so that the "pile" (the hot ball of metal) is fed in at one end, and comes out at the other a railroad bar! The principal advantages claimed, are—economy of time, and saving of manual labor—highly important considerations, as all iron manufacturers well know.

Let us compare (and our data throughout, it may be proper to remark, are not mere guesses, but have been ascertained by accurate calculations):—By the old process, a bar of 21 feet, the usual length, is manufactured in 2½ minutes; by the new, in the same time, one of a hundred feet could be run out, if the "pile" could be prepared; or, with the speed proposed for the new machinery, a bar 30 feet long may be finished from the "pile" in 30 seconds!

By the old plan, 10 men and boys are ordinarily employed in the rolling process alone—by the new, but one; and his business would be solely that of superintendence—there would be no manual labor for him. For instance, the heater brings his "pile"—it is put in at one end of the continuous line of rolls, and requires no further manipulation till it is delivered, a railroad bar, at the other.

Another prime advantage claimed for the new process is the manufacture of the "red short" iron into railroad bars. This species of iron, it is well known to manufacturers, possesses a peculiar brittleness when hot, that renders it difficult, if not impossible, to work by the old process, though remarkably tough when cold—having a long fibre and making the best of railroad iron. On the new plan, the time occupied in the manufature of a bar is so short, that the metal can easily be retained at a workable temperature during the entire process. This will undoubtedly tend greatly to improve the general character of railroad iron; as the "cold short," now mostly employed for that purpose (because it is most easily worked), becomes exceedingly brittle when cold, being in very many cases not much better in that respect than common pig metal.

The new machinery used is of the simplest mechanical construction, and not at all likely to break or get out of order. It consists mainly of a horizontal shaft, to which are attached, by plain bevel gearing, the several rolls, some revolving vertically and others laterally (in order to compress the metal on all sides). The rolls are set apart at distances corresponding with the successively increased lengths of the "pile," in its passage through them—the

first four or five being comparatively close together. Hence the entire length of the line of rolls, for manufacturing bars, say 21 to 30 feet long, would not exceed 100 feet. No more power is required than in the old process, as the metal is acted upon but by one roll at a time; and not near so much toward the finishing, as in the old process, the metal has by that time cooled very much, and, of course, is less malleable; while by the new, the whole operation is performed so speedily, that the temperature of the metal is very little reduced.

A *caveat* was filed at Washington some time last winter, and application for a patent for the invention is now pending in the names of Messrs. Harris and George Bright.

As to the cost of a mill, constructed with the new rolling machinery, a liberal estimate places it at about 15 to 20 per cent. more than the present exepnditure; but the new rolling apparatus *alone* will not cost more than ten per cent. over the price of the present rolls. The other increased expense results from the additional number or improved capacity of the furnaces, necessary to supply the new rolling machinery; and of course is to be considered in connection with the proportional increase of manufacture. This will become plain by a simple calculation:—A mill constructed on the old plan can work up about 70 tons of metal in 24 hours; that is, in the largest establishments, with the best machinery and the most experienced workmen. But, with the new rolling gear, 120 tons can be manufactured in 12 hours; or, nearly four times as much—the yield in both cases being limited by the rolling power. The principal difference, therefore, so far as cost is concerned, after the new rolling apparatus is introduced, is in the additional number of furnaces required to keep it going.

There are other incidental advantages connected with this invention, that we have not attempted to enumerate—we may have occasion to allude to it hereafter. The model has been examined by a great many persons, and the actual process of manufacture performed with small bars of cold lead. The general opinion expressed is admiration and implicit confidence in its success. —*Pottsville Miners' Journal.*

ROASTING IRON ORES ASSISTED BY A JET OF STEAM.*

In 1843, Von Nordenskjold recommended some trials to be made in roasting magnetic iron ore containing pyrites, with the assistance of a jet of steam, at the iron works of Dals Bruck, in Russian Finland. The roasting was effected in a kind of reverberatory furnace, prepared by Count Romfourd, and was effective, the whole of the sulphuret having been completely decomposed. The pig-iron subsequently produced from that ore yielded an excellent bar-iron, without the slightest trace of red-sear. Since then, the process has been much used both in Finland and in the Ural, as well with charcoal as with waste gas from the tunnel head. In 1845, Nordenskjold improved the construction of the roasting furnaces, by giving them almost the exact form of the Norwegian and Swedish gas furnaces. In order that the action of the steam be fully effective in roasting the ore, there must be a corresponding access of air. Steam and sulphuret of iron mutually decompose one another, with the production of oxide of iron and sulphurated hydrogen. If the latter, as fast as formed, meets with a sufficient quantity of air, it will burn, producing sulphurous acid, which, in its passage through the ore, produces no injurious action. If, however, there be not sufficient access of air, a portion of the sulphurated hydrogen in passing over an oxidized ore, beyond the direct action of the current of steam, would be decomposed, producing water and sulphuret of iron again. This process of Nordenskjold is of great importance, independent of the improvement which may be effected in the quality

* See the article, in preceding pages of this number (p. 136), on "The Employment of Steam in certain Metallurgical Operations."

of the iron by the almost complete removal of the sulphur, inasmuch as it renders the process of roasting the ores, by means of the waste gases from the tunnel head, perfect, and effects so great a saving in the amount of fuel consumed in this part of the process of iron smelting as to lower the cost of production very considerably.—*Secher's Metallurgie.*

QUARRIES AND CLAYS.

A NEW ARTIFICIAL STONE.

Messrs. Hornig and Suess have recently erected a factory for the production of a new kind of artificial stone. This material, which they designate "Columbia Stone," is composed of sand, clay, and salt, in certain proportions, based upon a careful analysis of the natural sandstone. The compound is pressed in mould of any desired shape, and burnt in a kiln. It is not liable to shrink or warp, and is said to be admirably adapted to inside or outside ornamental work.

NORTH AMERICAN ROCK DRILLING MACHINE.

The proprietors of this new invention patented it in January, 1852. They claim that, after a thorough trial, this machine has been found far more efficient than any other now in use, and that by it a saving of at least fifty per cent. can be made on all rock cuts of importance, as compared with hand labor; which item, taken in connection with the time saved, makes it worthy of attention. This machine is of very simple construction, being merely a drill-spindle rolled up between two grooved wheels, and allowed to drop when at the proper elevation; the drill being turned as it falls, by the action of two other grooved wheels, set at an angle, and operating also as a guide to the spindle. It can be run by hand, steam, or horse power. The latter is recommended as the cheapest, both in first cost and running expenses. When run by horses, it can drill a six-inch hole in granite rock, twenty feet per day of ten hours' run; and the other rocks in proportion to their hardness.

STONE SAWING MACHINERY.

Joseph Greely, 2d, of Nashua, New Hampshire, has applied for a patent upon an improvement in machinery for sawing stone, which consists in the employment, as a saw for dividing stone into slabs, of a disc or plate of metal, which has a series of burrs of a thickness more than one-half of the thickness of the plate, sunk in opposite sides thereof, so as to be flush with it, and attached thereto by screws or other devices, which pass through their axes. These burrs are so arranged that all protrude the same distance beyond the periphery of the disc, and when caused to rotate, by being moved in contact with the stone, they cut it away to the width of the disc to which they are attached, thus dividing it.

ILLINOIS MARBLE.

The geological survey of this State, under the charge of Dr. Norwood, has brought to light several sources of wealth and luxury not before known to exist. Among others, are several deposits of marble of different colors, and suited to different uses. Among these, according to the *Alton Courier*, is a variegated variety, suitable for any description of in-door and ornamental work, as mantels, table-tops, etc. It is from Southern Illinois, and will com-

pare favorably with most of the imported marbles used for such purposes. It resembles most nearly some varieties of Egyptian marble.

Two pieces of black marble, which, for beauty, depth of color, and high polish, are not excelled by any specimens of the famous Irish black marble that have come under our notice, and which is so much used for mantel-tops and similar purposes, are also from Southern Illinois.

A light-colored, nearly white, marble, from the vicinity of Thebes, appears to be one among the best rocks we have met with for almost every purpose of in and out-door work. It is very nearly pure carbonate of lime, sub-crystalline, very compact, and admits of a fine polish. No Western rock equal to it, in every requisite for building purposes, has yet, so far as we know, been placed in any public or private structure in the West, except, perhaps, in a single building in Chicago. We understand the quarries are inexhaustible, and that they are contiguous to navigation.

A beautiful oolitic marble, from Hardin county, receives a fine polish, and appears to be harder and better able to stand the effects of the weather than a similar rock from St. Genevieve, Missouri, which has been used to some extent in St. Louis. The structure of this rock is as curious as the wrought samples are beautiful. It can be worked with great ease into any desired form.

A specimen of marble-conglomerate, from Pike county, is one of the most beautiful ornamental rocks we have met with in the West. It more nearly resembles the "Potomac marble" used in the pillars of the Capitol at Washington, than any other rock. It appears to be quite as durable and takes as fine a polish as the Potomac rock, but owing to the grave colors of the pebbles of which it is made up, does not present so brilliant an appearance. It is very compact, and the cement appears to be very strong.—*Prairie Farmer.*

BRICK BURNING WITH CUMBERLAND COAL.*

2d. *The manner of using Cumberland coal for burning brick.*—Doubtless much has yet to be learned on this point, which, when understood, will tend to further demonstrate the economy of coal for burning bricks. Caution has to be observed when a kiln is first fired up, so as to prevent the bottom bricks getting too hot; this can be prevented by leaving the upper door partly open, and by letting the fire run low before replenishing it; thus the heat from the bottom is conveyed more rapidly to the top of the kiln, being less obstructed by the coal on the grates. This caution has to be observed continually while burning, for all the heat arising from combustion necessarily passes through the first or bottom bricks, and as the draft passes up through the bed of coal on the grates, the more coal the greater the obstruction offered to the draft, and the more the heat is confined in the bottom, and there is, consequently, a waste of fuel. There never should be at any one time while a kiln is on fire, more than four inches of coal on the grate in any place; all above that retards the burning, wastes the coal, and injures the bottom brick. Whenever the fire cannot be seen shining through the bottom of the grates, when a kiln is hot upon the top, then the ashes want shaking out, and the coal stirring up.

3d. *The time required.*—Fortunately for brick-makers, clay does not require a specific time and a certain degree of heat to cook it fit for use, as does the baker's loaf; but clay wants a certain degree of heat, and if that amount can be brought to bear upon it in forty-eight hours, it is equally as good as if the same heat was obtained in *one hundred and twenty hours.* The manner of burning brick has always been to expel the water from them as soon as possible, and to increase the heat to settle them the usual number of inches. It is well known that if there were no draft there could be no combustion, but on the other hand if the draft is increased, consumption of fuel and heat are also. Thus it is found the kiln before described affords sufficient draft to

* Continued from p. 110, Vol. III.

increase the combustion, to increase the heat, expel the water sooner, heat the top of the kiln, and get up the degree of warmth necessary to cause the brick to shrink in nearly half the time any other kind of kiln does with wood fires. With the very imperfect knowledge of economy in the use of Cumberland coal and want of experience in its management, at least forty per cent. is saved in time over any other known fuel.

4th. *The quantity of coal and wood used per thousand.*—It is generally estimated that it requires one cord of good wood to burn three thousand bricks; or, thirty-three and one-third cords to burn one hundred thousand bricks. This estimate is as often too low as too high, and is overrun by more brick-makers than is fallen short by them; but the quantity may vary from the nature of the clay and economy in the use of fuel, kind of wood and character of the weather. The average consumption, however, of wood to the hundred thousand *daily* is about seven cords; consequently it requires at least one hundred and twenty hours to burn a kiln, large or small, the height being equal. With the inexperience in the coal kilns before alluded to, one ton of Cumberland coal will burn five to six thousand brick; or one hundred thousand brick can be burned with twenty tons of coal at the very outside, consuming six tons daily, and occupying eighty-four hours to the kiln, not influenced by wind or weather. The per centage of saving is measurably governed by the relative cost of wood and Cumberland coal. At about the same cost for one cord of wood and one ton of Cumberland coal, the difference is quite *forty per cent.* in favor of coal, saying nothing of time or labor saved.

5th. *The advantages of coal over wood* are so numerous that it is almost impossible to detail them. A few may be named; *First*, wood can not always be had when wanted unless a considerable amount of capital is invested to cord it in quantities in the yard, and then cheap wood becomes dear before it is used, as much gets stolen; neither can wood of a good quality always be obtained. *Second*, it is often difficult to get wood hauled in busy seasons, or in bad weather. *Third*, it requires about *sixty* loads of wood to burn one hundred thousand bricks, whereas it only takes *fifteen* loads of coal. *Fourth*, wood is cash as soon as delivered from the vessel, but coal only requires its equivalent. *Fifth*, wood is often stolen and carried off by persons about the yard, but coal during the brick burning season is not used by the class of persons who take the former. *Sixth*, it at *no time* requires more than two men to superintend the burning with coal, and much of the time only one man, as twenty tons of coal can be placed much nearer the kiln than forty cords of wood, with much less wheeling, of course. With wood for fuel it takes an average of $2\frac{1}{2}$ men. *Seventh*, the wet weather does not affect coal; it injures wood. *Eighth*, the precise quantity of coal necessary for burning one kiln can be purchased at any time, but to obtain forty cords of wood, a vessel load, containing sixty cords, has frequently to be purchased. *Ninth, the saving of fuel is forty per cent., and the saving of time and labor* more than forty per cent. by the use of Cumberland coal.

MISCELLANIES.

GEOLOGICAL SURVEY OF NEW JERSEY

The geological corps appointed by the Governor is now fully organized, and consists of the following members:—

Dr. William Kitchell, Geologist, and Superintendent of Survey; Egbert Viele, Esq., Topographical Engineer; Prof. George H. Cook, Assistant Geologist; Henry Wurtz, Esq., Chemist and Mineralogist. Dr. Kitchell and Mr.

Viele are now in the field in Sussex county. Prof. Cook was to enter upon his duties in Monmouth county, on the 27th ult. The survey will be prosecuted with vigor, and a report of progress made at the next session of the Legislature.

MINERAL WEALTH OF SOUTH-WEST VIRGINIA.

Some idea of the wealth, especially in salt, of south-western Virginia, may be obtained from the annexed communication addressed to one of the local journals in that region, and subsequently forwarded to this Magazine. Public attention has, as yet, hardly been turned to one of the richest mineral districts of our country:—

ABINGDON, 15*th May*, 1854.

Sir:—In your last week's paper, a writer is made to say, the people of the United States are supplied with salt from the Virginia Salines of Washington and Smyth counties. Doubtless the intelligent writer designed only to assert that the great fossil salt mines of those counties are capable, perhaps forever, of yielding salt sufficient for all the citizens of the United States. *That writer* knows the New York and Kanawha salines yearly supply eight millions of bushels of salt, and other brines of our coasts, and the interior furnish near four millions more, to say nothing of the twelve millions of bushels imported yearly from foreign countries for our American population. Including salt exported in provisions or otherwise, and the increasing amounts given to live stock, and consumed for agricultural manures, the use of salt is now about fifty or fifty-two pounds average *per capitum*, throughout the United States. A second "writer" in your paper justly states the yearly demand on these salines is, of late, about four hundred thousand bushels per annum.

The home price has recently risen from sixteen or twenty cents to fifty cents per bushel of fifty pounds; the proceeds paying $33,000 yearly rents and all current charges, besides handsome dividends to the business.

By the Holston and Tennessee rivers, one hundred thousand bushels yearly will continue to be shipped to the counties of Northern Alabama, and also one hundred thousand bushels will be sent out to be sold on commission for the works, within a district or line encircling Saltville one hundred miles on every side. Also, in this same district, consumers would buy and take in their own modes of conveyance about two hundred thousand bushels, if sold at 33¼ cents per bushel at Saltville, as unpacked salt.

When the line of railroad is finished next year from Lynchburg to Huntsville and Florence, Alabama, it is also certain that if the freight be as promised—*two cents per ton of two thousand pounds* for the articles of salt and gypsum—there will yearly be sent four hundred thousand bushels of salt eastward of the Alleghany summit, and four hundred thousand bushels will pass to lower East Tennessee, parts of Middle Tennessee and Georgia, in addition; making one million two hundred thouand bushels of salt sales from this quarter. This gross amount of thirty thousand tons per annum will also increase yearly, owing to the superiority of this salt over all other salt from any quarter of the world.

200,000 bushels delivered to consumers at the works, at 33¼ cents,	$66,666
100,000 bushels, in 16,666 barrels, on neighboring commission sale, at $3.50 per barrel of 6 bushels, or 4 hundred weight, . .	58,334
100,000 bushels, in 16,667 barrels, for shipment to Alabama, at $3 per barrel, ...	50,000
400,000 bushels, in 100,000 sacks, by railroad South-westward, at $2 per sack, and paying 2 cents per ton per mile, . . .	200,000
400,000 bushels, in 100,000 sacks, sent by railroad east of Christiansburg, at $2 per sack, ...	200,000
Gross yearly sales, ...	$575,000

CONTRA CHARGES.

Assume rents at $25,000 for each saltworks—the Preston and King's Works,	$50,000	
Conveyance East, a mean of 150 miles by railroad, on 10,000 tons, in 100,000 sacks, at 2 cents per ton per mile,	30,000	
Conveyance West, a mean of 200 miles by railroad, on 10,000 tons, in 100,000 sacks, at the same freight,	40,000	
33,334 salt barrels, 30 cents each with packing, $10,000, and variously transported, at a mean rate of $1 per barrel, freight and sale, $33,334,	33,334	
36,000 cords of wood to make 1,200,000 bushels of salt,	60,000	
All other charges attaching to the manufacture and delivery of the salt at the salines,	60,000	
Cost of 200,000 sacks and packing, at 30 cents each,	60,000	
Commissions and contingent charges upon the collection of $575,000, gross value above,	57,500	
		$400,834
Apparent gain after every allowance of charges,		174,166

With a double-track railroad, the works are so situated that the seaboard salt cannot arrest the above valuations, nor can any interior saltworks now in operation arrest, but will often allow advanced rates.

At Kanawha the brine contains only one-fourth the salt of the brine at Preston and King's works, and the New York brine is one-third weaker than the Saltville brine. The brine here superlays one hundred and sixty feet in thickness of hard, reddish fossil or rock salt, containing in it no traces of *chloride of lime* or *magnesia*, but the brine, if not saturated by the salt, holds one-half of one per cent. of the sulphate of lime or gypseus matter, which is easily expelled, and is indeed harmless. This snowy white salt becomes dry as chaff, nor can any state of weather cause it to become moist or to drip water. The floors of the bins are dry as parlor room floors very soon after the new salt runs off its water. The masses of gypsum in the vicinity are known to be six hundred, seven hundred and fifty, and nine hundred feet in thickness; and the "*writer*" might well say, it too is sufficient for all its uses, not only in the United States, but for "all mankind and the rest" of the warm-blooded races. This is the oily water-crystallized gypsum, much more available for vegetation than the anhydrous plaster of paris of New York and Sandusky, or Nova Scotia.

It will now soon be conceded that the richest mineral region exists within one hundred miles around Saltville, anywhere to be found over a like extent of ground.

Lead, copper, zinc, coal, silver, and gold, and above all, exhaustless masses of fine iron ore were here to be found, in all time past—"without money and without price."—Strangers and natives denied ownership, and refused payment of taxes because the taxes were so trivial. But now these rich grazing and farming lands will be sought after, and the hills will be claimed after the metallurgist stirs the ores with "a long pole."

I have made my notice too long, after omitting many points that would be interesting even to herring fishers or oyster planters.

QUICKSILVER MINE OF ALMADEN.

Quicksilver Mine of Almaden, California; by W. P. Blake, (from a letter to J. D. Dana, dated San Francisco, Feb. 14, 1854.)—I visited the quicksilver mine at New Almaden a few days ago, and took a general view of it, and the establishment for the reduction of the ore. I shall soon visit it again and spend several weeks for the purpose of making a full examination of the geology of the vein.

The "Valley of San José" is properly the southern end of the great valley occupied by the Bay of San Francisco. The ground slopes so gently

towards the bay that it is hardly perceptible, and appears like a perfectly level plain; the portion bordering the water is low and marshy, and many thousands of acres are left bare at low tides; the streams wander in crooked channels through the deep clay soil, reminding me of the great salt meadows along the Passaic and Quinnipiac rivers.

At the time of my visit, the grass was springing up and the wild oat was covering the smooth round hills with a rich green carpet. The majestic oaks and sycamores that give a park-like character to the landscape were leafless, but the monotony of bare branches was relieved by the thick dark foliage of the evergreen oak—and although the middle of winter, the air was as soft and balmy as in our month of May on the Atlantic coast.

The works (or "hacienda") where the cinnabar is reduced are two or three miles from the broad valley, up one of the small side valleys of the mountains. The small village has the name of New Almaden, and it has few inhabitants that are not employed in or about the works or the mine.

The mine is about one mile from the works, and high up on the side of the mountain. The cinnabar is brought down on mules that carry about 200 lbs. each, and make two trips a day.

I expected to find the ore in close relation with the deposit of tertiary age, and among bituminous shales, but in this I was disappointed. All the tertiary beds appear to have been washed away, and hard serpentine and trappean rocks constitute a large part of the ridge in which the ore is found. There are, however, large outcrops of sedimentary rocks, composed of alternating beds of argillaceous shales and layers of flint; they are highly tilted and much flexed. They are unlike any of the tertiary series that I have seen in the State, and I am inclined to refer them to the lower Silurian age.*

The ore appears to be mingled with the strata of this formation in a series of beds and interlaminations.

The mine and works are now under the management and general superintendence of Capt. H. W. Halleck, formerly of the U. S. Engineer Corps. An adit level has been run in for 900 feet, cutting the old workings about 200 feet below the former entrance to the mine; this adit is 10 feet by 10, and is well timbered. A railroad of 4 feet gauge has been laid down throughout its length, and all the ore and refuse rock of the mine is brought out in cars that are weighed as they pass the office of the mine, and pass to the dressing floors, or to the attle heap. The irregularities and contorted windings of the excavations of the mine can scarcely be imagined; they extend in all directions. The transit between the upper and lower workings is effected by means of stairs or rude steps cut in the slopes, often replaced by notched poles instead of ladders. The ore has been followed and excavated wherever it could be found, and occasional pillars are left to support the roof.

The prevailing opinion among the miners and others appears to be that there is no regular vein of the ore—that it is a "pocket," a "deposit," etc.

The great width and number of the beds has confounded all ideas of extension or prolongation in any particular direction, and led to the general belief that the bed is "as broad as it is long," and the mode of working conforms to this view. The character of the deposit may not be that of a *true vein*, but that it has a determinate extension and direction I have not the slightest doubt, and I had abundant evidence of the fact. There is no reason why systematic mining should not be practised, both on the score of economy and safety.

The ore is divided into lenticular masses by intercalations of rock of variable thickness, and these are often filled with seams and veins of the sulphuret.

Numerous veins of carbonate of lime traverse the rock in various directions,

* Similar rocks (talcose and argillaceous shales and a Jasper rock) occur north of the harbor of San Francisco; they are more or less metamorphic, and probably *not older* than stated above by Mr. Blake.—J. D D.

cutting through the ore and faulting the small veins; it also lines cavities in the masses of cinnabar, and is then finely crystallized, and sometimes contains small quantities of bitumen in cavities, and implanted in globules among the crystals.

Sulphurets of iron and copper and arsenical pyrites are associates of the ore, but occur in very small quantity. Gold is said to have been found frequently in small quantities. I searched for crystals of cinnabar in vain; it is all massive, but presents various shades of color, and fresh fractures possess great brilliancy and beauty.

The mine is so free from water that the vein is scarcely decomposed at any point. If this had been the case, there would probably be some interesting mercurial salts formed along the walls.

The mining is principally performed by Mexicans and by Yaqui Indians. These are from the Gulf of California, and are of the same tribe that are employed in the pearl fishery. They make excellent miners, and endure much hard labor. One or two Cornish men had recently commenced work.

The drilling is all done with long heavy drills, and the hammer is not used. I saw one bed of cinnabar about 8 feet thick, into which a powerful Yaqui Indian was drilling a hole; the crimson vermillion mixed with water was flowing from it in a stream and bespattering the surrounding surfaces. It is really delightful to see such quantities of beautiful ore as are displayed in this mine.

I was greatly pleased with the construction of the furnaces and arrangement of the works for reduction. They are an instructive example of the value of science united with practical skill. The superintendent has discarded all the old and complicated methods, and adopted a furnace in which the reduction is rapidly effected without the use of lime, or even crushing the ore. All the vaporized sulphur is converted into sulphurous acid by the admission of atmospheric air, thus separating it from the mercurial vapor, and preventing a recombination in the condensing chambers. Some improvements can yet be made, especially in the apparatus for condensation, as a small quantity of mercury escapes from the chimneys in vapor, and deposits the peculiar gray coating on their tops.

I have before me a specimen of cinnabar from a new vein recently discovered in Sonora. It has been found in small quantities only, and is chiefly interesting from the occurrence of metallic mercury in the parts of the vein near the surface. They occupy small cavities in the rock, and are apparently derived from the decomposition of the sulphuret.—*Silliman's Journal.*

NEW JERSEY NATURAL HISTORY SOCIETY.

At the meeting of the New Jersey Natural History Society, Mr. Henry Wurtz, from the Committee on Chemistry, read the following papers:—

Aluminum.—One of the most important of all the subjects now under discussion by men of science is that of the metal *aluminum*, which has been recently investigated thoroughly by Saint Claire Deville, a young chemist of France—the same, if I am not mistaken, who is already celebrated for the discovery of anhydrous nitric acid and other brilliant achievements.

Alumina is one of the most abundant of all known substances, forming a large proportion of nearly all mineral substances, and especially of clay. This substance was first successfully analyzed by the great chemist, Wohler, of the University of Gottingen, who found it to be composed of oxygen and a new metal, which he called aluminum. This metal, however, he obtained in too small a quantity to enable him to recognize and describe its properties fully. He states, however, that it has a brilliant white metallic lustre, is fusible before the blowpipe, perfectly malleable, only two and a half times as heavy as water, and unchangeable in the air. This account of the metal

has recently aroused the ambition of Saint Claire Deville, and, by a modification of Wohler's process, he has succeeded in obtaining pure aluminum in considerable masses, and ascertaining thoroughly its properties. He found it to be not only unchangeable in air and in water, but also in most acids, being therefore more durable than silver, which tarnishes in the air, while at the same time it is nearly, if not quite, as beautiful in appearance as silver, and weighs only one-fourth as much. At the same time both Wohler and Deville state it to be very tough and malleable.

Thus it seems that a metal whose ores are at least ten times as abundant as those of iron, and a mine of which might be opened at almost any spot upon the earth's surface, is possessed of properties rendering it of far more general utility than iron itself; and it may safely be predicted, allowing Deville's assertion to be correct, and they have been confirmed by a Commission appointed by the French Academy of Sciences to investigate the matter, that some of us now present may yet live to eat with forks and spoons composed of aluminum on aluminum dishes, food cooked in aluminum utensils upon an aluminum stove, and possibly while seated upon aluminum chairs in houses or ships composed of the same metal. These things, I repeat, may be confidently looked for, and already Deville has announced in his latest communication upon the subject, that he has discovered a new method of manufacturing this metal, more practical than the expensive method of Wohler, by which it may be obtained in masses of any size. In the mean time, however, Professor Wohler has written a letter to Dumas, in which he denies that aluminum possesses the great indestructibility attributed to it by Deville, the reply to which by the latter is, very reasonably, that Wohler's aluminum was not as pure as his own. Wohler, however, in his letter, admits the probability of the future usefulness of aluminum in the arts, so that we can only wait, and hope for the day when we shall be able to rank Wohler and Deville among the great benefactors of humanity.

It must be noticed that the French Academy have commendably appropriated a sum of money to defray the expenses of Mons. Deville's experiments.

Glucinum.—In connection with this investigation of aluminum by Deville, another chemist, M. Debray, has been engaged upon *glucinum*, the metal of *glucina*, a metallic oxide found in the emerald, beryl, chrysoberyl, and other minerals, and which, from the close chemical resemblance between glucina and alumina, was expected, from analogy, to present more or less resemblance to aluminum. Glucinum was also first discovered by Wohler. As obtained by Debray, by Deville's process, it presents the appearance of zinc, less fusible than the latter, though more so than aluminum. It is even lighter than aluminum, being little more than twice as heavy as water. Diluted acids dissolve it as they do zinc, except nitric acid, which can only dissolve it when hot and concentrated. It is unaltered by the air, and does not burn even at the highest blowpipe-heat. Debray promises us further information upon this subject.

The following is Deville's own account of the discovery of aluminum, as narrated to the French Academy of Science:—

It is known that M. Wohler has obtained aluminum in a state of powder. In modifying in a proper way the process of that gentleman, we may regulate the decomposition of the chloruret of aluminum in such a manner as to produce an incandescence sufficient to cause the particles of this metal to agglomerate into globules. If the mass composed of the metal, and of the chloruret of sodium (it is better to employ sodium) be taken, and if it be heated in a porcelain crucible to a red heat, the excess of the chloruret of aluminum becomes disengaged, and there remains a saline mass of acid re-action, in the midst of which there are globules, more or less large, of perfectly pure aluminum. This metal is as white as silver, and is malleable and ductile in the highest degree. However, when it is wrought, it resists strongly, and it may be supposed that

its tendency approaches that of iron. It may be hardened by hammering, and the hammering restores its smoothness. Its point of fusion is but little different from the point of fusion of silver. Its density is 2·56. It may be melted and cast in the open air, without sensibly oxidising. It is a good conductor of heat. Aluminum is completely unchangeable by dry or damp air: it does not become dull, but remains brilliant by the side of zinc and tin freshly cut, which lose their brilliancy. It is insensible to the action of sulphuretted hydrogen. Cold water does not affect it; boiling water does not tarnish it. Nitric acids, whether weak or concentrated, and weak sulphuric acid, employed cold, do not act upon it. Its veritable dissolvent is chlorohydric acid: it then dissengages hydrogen, and a sesqui-chloruret of aluminum becomes formed. Heated to redness in gaseous chlorohydric acid it produces a dry and volatile sesqui-chloruret of aluminum. It will be understood that a metal white and unchangeable as silver, which does not blacken in the air, which is fusible, ductile, and tenacious, and which presents the singular property of being lighter than glass, would be of great utility if it were possible to obtain it easily. If we consider, besides, that this metal exists in large proportions in nature, and that its ore is clay, we must wish to see it become of common use. I have every reason to believe that this may be the case, for the chloruret aluminum is decomposed with remarkable facility at a high temperature by common metals, and a reaction of this nature which I am experimenting at this moment, on a larger scale than a simple experiment in a laboratory, will solve the question in a practical point of view. M. de Senarmont having procured me a sufficient quantity of the zircon of Espailly, I shall, aided by the researches of M. Delway, of the Ecole Normale, on glucina, soon be able to submit to the Academy general results on the metals of earths, and on the rank of their chemical combinations in metallic matters.

GEOLOGICAL.

Professor E. Forbes, President, in the chair. The following communications were read:—On the Physical Geology of the Himalayas, by Capt. R. Strachey, F. G. S. This communication treated at large of the structure of the great range of elevated table-land in Central Asia, the southern border of which is known as the Himalayas. This southern border supplies the source of the great rivers of Hindostan, and forms the "Indian watershed;" whilst the northern border of this great Thibetan table-land is known as the Karakoram Mountains, Tsounling, etc., and forms the "Turkish watershed." The relations of these two great parallel "watershed" bands to each other, to the central part of the elevated region, and to the junction of the mountain masses with the plains of Turkistan on the north, and of Hindostan on the south, involve important considerations of the physical structure of the whole elevated mass, which can be sufficiently elucidated only by means of maps and diagrams.—*London Athenæum.*

COPROLITES IN SUFFOLK, ENGLAND.

An immense deposit of the fossil fœcal remains of extinct saurians, and other ancient gigantic animals, has been discovered on the coast of Suffolk, extending from Bawdsey to Boyton, and inland towards Woodbridge. The amount is said to be incredible, and the landowners are reaping a rich harvest: one cottager found in his small patch of garden as much as realised £20, and others have been equally fortunate. It is at present giving employment to large numbers of laborers, women, and children. When thrown up it is carefully picked, washed in sieves, and laid in heaps for carting. It is found valuable in the manufacture of the finest porcelain wares, and the refuse makes an excellent manure. Some of the excavations are twenty feet deep, without being exhausted; and a fine field is here opened for geological observation, as the relics of enormous fish, saurians, shells, and other remains, are

continually being turned out. Hundreds of tons of the mineral are being shipped from the Deben for different ports.

THE SULPHUR TRADE.

It appears that the prohibition by the King of Naples of the export of sulphur to the ports of the belligerent powers is confirmed. The importance of this article as regards the manufacture of gunpowder is trivial, the quantity used for that purpose not exceeding a fiftieth part of the total annually taken by this country. It is in a multitude of manufacturing and chemical operations that its deficiency will be felt, and in this respect the interests involved are so large, both in England and France, that it may be assumed the measure will command the immediate attention of the respective governments. The yearly value of the trade to the people of Sicily is estimated at nearly half a million sterling, and it employed about 100,000 tons of shipping.—*Liverpool Chronicle.*

HOISTING MACHINERY.

George Martz, a mechanic of Pottsville, has invented an important piece of hoisting machinery—just the thing wanted to facilitate mining operations, where deep shafts are necessary to reach the coal underlying surface veins. By this machinery, which is driven by steam or other power, when the car commences to raise, it fastens itself on the cage, so that when it comes to the elevation of the breaker it tips itself, and readjusts itself, and returns to the bottom of the pit, where it can again free itself, so that the loaded car can be pushed against it and pushed off of the cage. When there is a dirt-cart that does not need to be dumped, the dumping way is closed by a lever in an instant, so that the car keeps its horizontal position, at the same time landing on a ketch and loosing itself, that it may be pushed out without any further trouble.

NEW PUBLICATIONS.

Messrs. Lippincott & Grambo, of Philadelphia, announce "in press" the following work:—

The Metallic Wealth of the United States, Described and Compared with that of other Countries. By J. D. WHITNEY. In one vol., royal 8vo.

The design of this work is to give a concise view of the principal mining regions of the world, together with a more detailed account of the resources of this country in the metals and their ores, and the present state of the development of our mining interests. For this purpose, after a few pages of preliminary matter, in which the mode of occurrence of metalliferous ores and the general principles on which mining is conducted, are discussed and explained, each metal is taken up and treated under the following heads:—

1st. Its Mineralogical Occurrence.
2d. Its Geological Mode of Occurrence.
3d. The Distribution of its Ores in Foreign Countries.
4th. The Distribution of its Ores in this Country.

Full descriptions of the principal mines will be given, accompanied by sections and other illustrations.

THE

MINING MAGAZINE.

EDITED AND CONDUCTED BY

WILLIAM J. TENNEY.

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ART. I.—MINERAL DISTRICT OF CENTRAL CALIFORNIA.—No. 2.*—

BY PROFESSOR JOHN B. TRASK.

CHARACTER AND POSITIONS OF THE OLDER VEINS BELOW THE SURFACE.

Under this head will be concluded all that we have to say upon the subject of gold mining in this State at the present time; and as the largest proportion of the mines of the State are situated on the older group of the quartz, the remarks that follow will be confined principally to that series.

In the northern part of the State,† the granite rocks in which these veins are situated upon the surface, have been found to be underlied with another class of igneous rocks, which, from their nature and *presumed* age, it was feared might have so disturbed the "setts" as to render the successful prosecution of mining a doubtful project; and injurious speculations, from this fact, have been indulged in to an extent that at one time threatened to destroy the well-merited confidence which the discovery of these veins had induced from the outset; and for this reason no little degree of interest has been manifested both at home and abroad in relation to their future prospects.

Had those speculations which have been founded on presumptive evidence only, been confined to the sphere to which they legitimately belonged, and divested of the over-anxious fears expressed and manifested from abroad, the parties most directly interested would have suffered less inconvenience by loss of confidence and credit, which the voluntary conservators of our good in distant lands have been the means of inducing, and the public mind would have been unbiassed but for the opinions of men who should have had more discretion than to have hazarded their reputation on such premature evidences as they must have been possessed of at that time.

It is scarcely a supposable case, that men thousands of miles distant should be found adequate to judge correctly of the value

* Continued from page 136, Vol. III.

† North of the Consumnes River.

of metalliferous districts, having never seen the sections alluded to, or even before the veins were known by the parties engaged in opening them. Elaborate discussions, based upon presumptive analogy, may subserve the purpose of pleasing popular assemblies, but they will be found untenable and useless often, when applied to practical and systematic operations.

Mining exploration within the past eighteen months, has added much to our information relative to the position of metallic veins of the State, and the rocks with which they are associated. The granite series has been closely investigated, and in several of the mines the workings have been carried entirely through this rock, and, contrary to the anticipations of the incredulous, the *setts* have not been *thrown* at the point of contact with the inferior rocks. Thus far the depth of the granite series has not been found to exceed a depth of but little more than one hundred feet, and in almost every case where shafts have been driven, either on the vein or beside it, the rock has been found in a highly decomposed state, thus presenting but little difficulty in passing through it. There are, in some localities, many small veins running out at different angles from the principal "setts," into the surrounding granite, and when thus appearing in the inverting rocks, marks of dislocation are observable. These interesting features define most clearly the energy and extent of the supporting and injecting forces from below, at the date of the intrusion of the veins; and the angles which the small cross-courses make with the main "setts" from which they emanate, show most conclusively that the fracture of the superincumbent rocks must have been extensive. Another and a striking feature is also to be observed in this particular, which is, that the small threads found in the granite have a greater power when they enter the greenstone below; thus indicating that the intrusive dikes spent themselves principally in the superior granite above.

The entire mass of the granitic rocks in the vicinity of the quartz, is of a loose and incoherent texture, from the surface to the lowest point yet reached, and when brought from the greatest depths the same general characteristics are found to prevail throughout. It presents a crumbling, reddish and purple hue, at times faintly spotted with white, its felspathic constituent thus imparting a porphyritic appearance to considerable quantities. When damp, it is somewhat clayey; in the dry state, after exposure to the air, it is easily crushed in the hand, giving the greasy feeling of some of the talcose minerals. These peculiar features may be best examined in and about the towns of Nevada and Grass Valley; for here they extend over several miles, and the extent to which mining operations have been carried in these sections, renders an examination of all the different phases that are presented in this class of veins, both easy and convenient.

Immediately below the granite, the greenstone is found underlying this entire section of country. In every instance in which the granite has been perforated, this rock has been found beneath, and when first met with in descending is much broken up, and the fissures filled with foreign infiltrations from above. The trap rock has a blueish-gray and greenish color, often highly charged with pyrites; the veins on entering this rock change their color from the deep reddish-brown, which they maintain in the granite above, and the cavities filled with the peroxide of iron which has resulted from the decomposition of the pyrites it originally contained, to a clear white or semi-translucent mineral, holding considerable quantities of cubic and rhombic crystals of pyrites, which are more or less auriferous. In some of the trappean rocks arsenical pyrites is met with, but this latter is much more common in the southern districts, and on the forks of the American River.

In every mine throughout the northern districts, in which the greenstone has been reached, *the veins have penetrated this rock*, and in no one instance thus far is it found that the vein has either been *pinched or faulted*, but the reverse is true, *that every sett has increased in power the deeper they descend.* Of six companies now in successful operation in Grass Valley, all of them are obtaining their ores from the greenstone, in larger quantity and better quality than was found to be the average in the granite above: on Deer Creek it is the same, and but two mines in this district still continue in the granite, viz., the Illinois and Gold Tunnel mines. The lower gallery of the latter is within nine feet of the greenstone, with an increasing power in the "sett" at the point of working. In the counties of Butte and Shasta, the same fact prevails, and in each of those mines which have entered the trap there has been no diminution in the power of the vein or qualities of the ore.

The depth to which some of these veins are found to enter the greenstone has been fifty-five feet, at the present time, and at this depth into this rock they bear all the reasonable evidence of continuing to an unlimited depth, and being of more recent date than their investing series. The greenstone in close proximity to the dikes is found much shattered and disturbed, exhibiting evidences of displacement subsequent to fracture, the inclination of the disturbed masses corresponding to the dip of the vein, the lines of fracture form angles of fifty to seventy degrees to the dip of the "sett," and as high as forty in some cases with the horizon; this gives a stratified appearance to these rocks; this peculiar feature is observable at the Osborn Hill Mine, and is indicated by the heavy lines in the sketch of its transverse section. At this mine may also be observed the other peculiarities before noticed, the highly decomposed and broken character of the upper part of the greenstone of seven-

teen feet below; at the Lafayette and Helvetia Mine, similar features are to be observed of the semi-stratified appearance of the greenstone, caused by the intrusion of the quartz dike through it; the entire length of the adit level of this mine is driven entirely through this rock a distance of about eleven hundred feet.

On Deer Creek, five miles north of Green Valley, we find a material change in the relative position of the metallic veins to the investing rocks. At the Gold Tunnel, as before remarked, the "sett" is exclusively in granite, while at the Wyoming Mine, one and a half miles below, the "sett" is situated in the greenstone inferiorly and the slate above, while in the adjacent mine above the Wyoming, slate and granite in the middle and greenstone below is the order of arrangement. At this mine may be observed one of those interesting features noticed in the concluding paragraphs of the Recent Group, and when we compare the accompanying sketches of the Osborn Hill and Wyoming, a sufficient illustration of the relative ages of the group will appear. The present working "sett" of the latter mine is protruded through the primitive rocks, and also through the slate above them, and from its dip it must pass through older veins at a depth probably not exceeding four hundred feet below their present level. The slate which lies superior in this mine is evidently of the same age as that occurring among the foot-hills toward the valley, and, as the sketch of this mine illustrates, the vein passes entirely through them; the dip of this vein is forty-three degrees east, while those of the adjacent mine above varies from thirty-two to thirty-eight degrees. It is not surprising that a recent "sett," in passing through the cross-course of an older vein, or through a part of a primitive vein, should produce valuable deposits of metal which has taken place in this mine in several instances, and it serves for an illustration of the principle advanced in the preceding pages, that the recent veins were equally metalliferous with those of the primitive series, wherever and whenever found in this State.

From the facts thus far presented to your consideration respecting the known position of these rocks in the northern part of the State, some evidence at least exists, that those veins thus far opened are now proved to have cut through that suite of igneous rocks which heretofore have been supposed would destroy their continuity to any considerable depth below the surface. Already has the establishment of this point exerted an influence which is beginning to be strongly felt, and is restoring that confidence in gold mining which it long since lost. More capital has been invested within the preceding four months in this branch of employment, than in the entire time which has elapsed since the general suspension of these operations. From the developments which have been made relating to the per-

manency of their character within the past year, individuals are fast becoming satisfied that the metallic veins of this State merit that confidence which is fast returning. If other testimony is required than that already cited of the almost certainty of their continuation to unlimited depths, it will become necessary to search out some other formations than those acknowledged to be the foundation on which rest the superstructure of this terraqueous sphere, for it is evident if facts have any weight, that they have disturbed the lowest of all known rocks.

It may be argued that the shallow depth, fifty feet into the greenstone, is not positive, but that these veins may be faulted by more recent volcanic intrusions below this point. This is possibly true, but at the same time, is there any good reason for such a supposition when no evidence of such disturbances are observable above the surface in their vicinity, and when those intrusive rocks are not to be found to depths of two or three thousand feet below the summits of those ridges on which these mines are located in many instances. There are many deep gorges among our mountains which exhibit the character of the rocks composing them to the depths above named, and on examination of their structure will convince an unbiassed observer of their primitive character. Among these gorges it is not unfrequent to find the quartz veins extending from their bottom to various heights, ranging as high as six hundred feet in every instance in which these veins are met among the rocks in *situ*. They possess their *greatest power at their lowest point.* In one instance I well remember having traced a dike of this rock from the river to the height of thirteen hundred feet, a drawing of which is still in my possession; the "sett" thinned out to small threads at this height, with a diminishing power from the base of the hill to the summit; this vein passed through greenstone and porphyry, granite and slate, successively, until it finally spent itself among the latter. If intrusive dikes are found to increase in power as their distance below the surface increases, we may reasonably conclude that they may continue to a depth below, equal to that which may be found above, in a case like the last one cited, provided the rocks beneath the lowest point at which it is observable continue of the same character.

Abundant examples of this character are to be met with throughout our mountains; and with such evidence before us, the character of these metallic veins for permanency must be placed beyond suspicion or doubt, and our testimony on this point extends much beyond any that has, as yet, been adduced. In the county of Calaveras, an extensive dike, two miles in length, has been laid open in such a manner that a vertical depth of eight hundred feet of the vein is now exposed to view.

The dike cuts through two ridges, which separate two streams of water, and the companies located on these streams

have sunk their shafts to the depth of over one hundred feet, directly under the beds of the creeks, and have driven their galleries each way until within a few feet of each other: the vein in one shaft has a power of thirty-seven feet, but in no point on the "sett" is it less than five; in each of the five mines located on this vein, the power of the "sett" has uniformly increased the deeper they have descended. In this case we have a thorough examination of one, at least, of our metallic veins, which will compare with some of the operations in other countries, and we may deduce some safe conclusions respecting their probable stability, if depth below the surface becomes an essential requisite to establish that point.

The rocks through which these veins pass are principally of the talcose series, with greenstone, hornblende schists, and syenite, in the immediate vicinity; the dikes have cut through all of them in succession without having suffered any deflection from that parallelism which must have ensued, if any of the rocks with which they are found in contact, had an age posterior to the dikes themselves. This district is particularly noticed in connection with this part of our subject, for the purpose of exhibiting the stronger probability of permanency in the quartz veins of this country, for the reason that if disturbance in their position is likely to ensue in any part of this State, it would be likely to occur in these sections, as the effects of recent volcanic action is more prominent throughout the southern portions of the mining districts than any other part of the west flank of the Sierra Nevada.

From what testimony we have in our possession relative to these veins, it seems but reasonable to conclude that their integrity is perfect, or as nearly so as can be reasonably expected considering the short period which has been employed in developing their true character, and that the confidence which they formerly possessed was well grounded; all subsequent examinations have only tended to confirm this belief in the minds of those who have carefully and diligently studied this subject. The present condition of our gold mines, their flourishing state and prospective value, based on facts as now developed, most clearly indicate their importance as an industrial pursuit, and one destined ere long to form one of the leading interests in the economy of the State; and as such it would seem that all prudent measures to develop farther their extent and value, and place them upon that footing before the world which that value and importance demands, should be used, either through the State or General Government, and through them promote such measures as will prove an inducement to more extensive and permanent operations than has yet been done.

In concluding this part of the report, and in connection with the magnitude and importance of perhaps a somewhat exciting

principle in relation to it, I would beg leave to call your attention to a point on which there has heretofore existed much diversity of opinion, which not unfrequently has engendered angry discussion and belligerent feeling in a large proportion of our mining population. The experience of the last three years has elucidated the fact most clearly that the two mining interests of this State cannot be governed by the same rule of law in all cases, and prove alike advantageous to both; it is therefore suggested whether some method more congenial to this interest may not be adopted, that will favor the occupancy and improvement of the metallic veins of this State, giving at the same time widest scope and protection to all at present engaged, and those who may wish hereafter to enter upon those pursuits.

PRESENT GOVERNMENT OF METALLIC VEINS.

Before entering upon this part of our subject I will state, that throughout every part of the mining counties, which it has been my fortune to visit, in my examinations of previous years, and up to the present time, the subject of needful protection to capital investment and labor in this branch of mining, has been fully and unequivocally expressed by those engaged and interested in it, and by a large portion of those engaged in placer mining, having no direct connection with the former. And it is at the solicitation of nearly *every individual* engaged in the pursuit of mining on veins, that the subject is presented to your consideration at the present time. A wish has long since been expressed, and urged through all the various channels of communication, that the present tenure by which this species of property is holden and conveyed may be changed in such manner as may render available capital investments, which must be largely employed in order to develop those sources of wealth and insure their occupancy.

It is perhaps a questionable point whether the State government is vested with the power to cede and convey title in fee to lands containing the precious metals, even were that title absolutely required from the nature of existing circumstances; but whether her jurisdiction in the case be sovereign or not, she legitimately possesses a conservative jurisdiction over such lands, and through that power, as a member of the great confederacy, may exert an influence to obtain such modifications of existing laws of the general government, as would conflict with the common interests of her citizens, or of those rules and regulations temporarily instituted by the State, which, by their present action, have a tendency to cripple and reduce her otherwise available means of revenue.

Under this form of the question it becomes a matter of some importance to consider, whether the entire interests of the State would not be materially and beneficially affected, by placing

such lands as are under its conservative influence in a position that would be likely to yield a revenue from their occupancy, and which at the same time would yield an adequate security for the investment of capital to be employed in their development. A system of law that would induce a more extensive occupancy than that now existing, must insure, as a resultant, a corresponding increase of revenue, thereby reducing taxation on the great mass, and render less burdensome the support of the State government.

A course of action that would accomplish this end, and at the same time prevent that result which it has been the careful study of the representatives of the people to guard against, and whose every effort has been directed to preserve to the people the most liberal policy in the acquirement of wealth from the varied and prolific sources presented in no other country than this, must be unobjectionable either to the miner or merchant.

A strong objection has been urged against the sale of mineral lands, and justly too, as in this case the title must pass into the hands of private parties, which in most countries has proved objectionable in many particulars, and a course of this kind could never meet the approbation of a large majority of our population, in the present state of our information. In all other countries, as in our own, the title to mineral lands is vested in the crown, or general government, (with the exception of Great Britain,) and the title or permission to use or occupy can emanate only from that source, where it properly belongs. In all countries where mines of the precious metals have been found, different policies for their government have been pursued, but as yet that policy which has been the most liberal, and at the same time protective of private rights, is found to have exerted the widest and most beneficial influence in their development and occupancy; under such a system it is impossible for it to do otherwise than prosper, and the experience of nearly three centuries has gone to substantiate that fact.

There can be no possible objection to the *general principles* on which our present system is founded; it is the same that made Spain and Mexico what they were and are, and one that with these countries has stood the test of time, the best proof of its utility and universal application. Throughout all the political changes that have convulsed and shattered the civil codes of these governments, no change or alteration of a restrictive tendency has been made in the Ordinances des Mineria for the last fifty years—no change that in the least has affected its vital features, except to render them more liberal and congenial; its dictates with them are as sacred as their holy creed, and to molest or change its principles would be regarded as equally sacrilegious.

Under that system individual rights in mines are scrupulously respected, and strict non-compliance with its requisitions are fol-

lowed by a reversion of party rights to the crown, from which only can a similar title be obtained by others wishing to occupy and improve.

The history of mining proper throughout the world, has taught us that it is impossible to pursue that business to advantage without heavy outlays of capital; this applies equally to mining for silver or gold; the great amount of labor and expense attendant in opening a mine is the cause of this, that branch alone often being the work of years, before the reduction of any of its metals take place whereby any return of profits can be realized. We are not wanting in illustrations of this kind, they are as wide-spread as the mining operations of the world; and if more definite examples of this fact are required than the general history of this branch of industry, we need but refer to the superficial operations of our own State heretofore, to show that limited means cannot succeed in gold mining, though the veins producing the metal may be (as they frequently are in this country) exceedingly productive.

Our citizens embarked in this delusive speculation in a most inconsiderate manner. The results that followed from their earlier operations are too well known: the capital at their command, being small, was expended even before their veins were opened, and this great lever of success in these operations being thus early suspended, prevented the prosecution of the enterprise to a successful termination, which would have ended in profit in place of loss.

The fault, "if fault there be," lay at the door of misguided apprehensions, induced by flattering reports of results which had flowed from hasty examinations, but not in the veins themselves, as these were dumb, and unable to speak for themselves; until men of larger means developed their capabilities, the cause of failure was attributed to want of metal in the lodes; hence the distrust which has up to the present time attached itself to this branch of mining, and has resulted in serious loss to the country at large as well as to the private citizen.

A few have grappled through against all obstacles, who were fortunate enough to command the necessary means, and now have their mines opened and in successful operation. But it has been at the expense of heavy outlays of capital, and nearly two years of industrious application and hard labor; the results which they have produced have been the means of fixing on a permanent basis, the character of these mines, which it will be difficult to affect injuriously hereafter: and their integrity as lucrative employments, and safety for capital investments in themselves, is questioned by none who are conversant with their present condition.

Notwithstanding their acknowledged intrinsic value, there is an incubus resting upon them, which prevents, and must still

prevent, their more extensive occupancy, and until removed in some manner, will stand as an insuperable obstacle to their future progress. This rests in the doubtful and uncertain tenure by which these mines are held, being subject, as they are, to the government of the majority of the people in the district in which they are located, and whose interests, directly considered, are both unconnected and foreign, though following a profession similar in some respects to that under consideration.

The position of the placer miner, and those engaged on veins, is different in many respects. In the case of the former, there is but a comparatively small amount of capital requisite to pursue his business advantageously and successfully: in the other, experience has fully demonstrated that he cannot pursue his business successfully without large expenditures. In the case of the former, the extraction of gold is conducted by the simple process of washing; in the other, it can be extracted from the gangue often only by complex metallurgical processes, and subjected even then to much uncertainty, and, at times, loss—requiring what the placer does not, the employment of men who have made it the study of their lives, and the use of means mechanical and scientific, which do not come within the requisition of the former, to conduct his operations to a successful issue.

The operations of the placer miner are generally limited as to time, seldom exceeding a year in the same locality; on his removal, his interest in his former residence ceases; in the case of the miner engaged on veins, he finds that his operations must be continued through a series of years in order to secure a fair remuneration for his labors, and if he removes to other parts of the State, his interest in the locality he left does not cease, as his capital investments still remain and continue a permanent source of revenue to the State and county in which they are located. The implements of the placer miner are few, and easily obtained or disposed of if he wishes to remove, but it is widely different with the other. He is obliged to obtain expensive machinery to obtain profitable results from his labors, and heavy sacrifice is often the attendant, if it his misfortune to fail in his operations from any causes either natural or artificial.

The effect of placer mining in all parts of the world has been, to produce a wandering and unstable community. No better example is to be found than in our own State; it is a true illustration of what has occurred in other countries whose features simulate our own; and to remedy this has been the aim of our State government almost from its earliest foundation; how far its efforts have been attended with success its present history will clearly elucidate. The attempt to induce a permanent settlement in the mountains can be said to have partially succeeded only, and this has occurred in those instances where the parties thus locating have been enabled to avail themselves of interests

that would partake of a degree of permanency for a series of years; their titles to improvements on the lands such persons occupy, being retained only by the law of sufferance, subject to the decrees of the majority residing in their vicinity if found to be auriferous.

On the broad platform of "equal right and equal privilege," which has been the governing principle of this State in its most extended sense from its earliest occupancy, the dim outline of a desire to establish permanency in the settlement of the mountain districts has been manifested, and at the present time it has become a distinguishing feature in a large portion of the mining population; in mining employments it is equally apparent as in agriculture; among the most stringent advocates of a "*masterly inactivity*" in regard to the government of the mines two years ago, are now to be found men equally earnest in their advocacy of vesting rights that shall partake of the character of permanency, and protective where his operations require investments, to secure competency and reward for his labours. Experience has taught us that necessity, if we would foster those employments which it has been our pride to boast, and where no subversion of those fundamental principles on which our laws are founded can take place.

In every county of the State where quartz mining has been conducted this will be found a striking feature in each and all of their operations, and has been particularly manifested in some of the northern counties, where more stringency in the enforcement of mining laws of former years existed, than probably any other part of the State; the effects of this course of action was equally manifest abroad, in the Atlantic States and Europe, when the construction of the present mining code was published in those countries. In one of our northern counties a system has been founded on this code which under certain conditions (consisting of a given amount of improvements only), conveys a title in fee to all intents and purposes; and another by which parties have the right of holding all that they may be able to purchase. This course of action among miners themselves must be viewed as a plain and clearly defined wish, on their part, to extend over the country a system of government that shall prove alike conducive to the enhancement of these interests and the public welfare, and offer by these means inducements for the investment of capital from abroad; its effects would prove beneficial, inasmuch as every dollar of capital thus invested would become so much available means of revenue, and serve to retain a much greater amount of the gold extracted from our hills within the State.

From the nature of gold-mining proper, it results as a consequence almost, that those who engage in it, must become permanent settlers, as their operations, if successful, become the work

of years instead of a few months, and their investments, when made, are done with that view. Under these circumstances does it not become a matter of correct policy to separate the interests of the placer miner and those engaged on veins, in such a manner that those engaged in each branch may enjoy that liberty which the placer miner now possesses, and which is enjoyed by the other only by the sufferance of the former in the largest majority of cases; giving to each the right to enact those laws which they in their good judgment will find most conducive to their separate interests, and which from their nature and attendant circumstances are very dissimilar and foreign.

The jealousies and feeling arising from the suspicion entertained by each other, which has heretofore and at the present time exists to a considerable extent, in these two branches of industry, would, by the above course, be done away, and a much greater degree of stability in mining proper would be the result, (which under the present arrangement of affairs can hardly exist) in which its prosperity to a great extent is involved: its influence would not only be made manifest here, but it would give a confidence abroad in these operations which they do not now possess, and to which we must look for those means by which we shall be able to conduct gold mining successfully and with profit.

The entire separation of these interests would be regarded abroad as the opening of a new era in the mining history of this State, fraught with beneficial results, and involving a vital interest in her future economy, advantageous alike to the revenues of the State and to the people; it would remove that serious obstacle at present in the path of its progress, viz., "the insecurity that now exists for invested capital, from the motative policy heretofore pursued," and restore that confidence which such a policy has in a great measure been the means of destroying.

The mines of this State are of a character and value which, if placed in a proper position, will invite investment from abroad, to an amount little less than twenty millions of dollars within the next eight years; this presumption is founded on the fact that more than one-sixth of that amount is at the present time in active operation in this country, and its largest proportion has been derived from American sources, during a portion of that period when public confidence had been shaken in regard to their value. Negotiations are now pending which involve nearly one million more of capital investment in this branch of mining, nearly one-half of which is in the cities of Boston and New York.

Considering the disadvantages that now surround them, as shown from the facts relating thereto, they can but be regarded as the prolific sources of wealth in this country; and every inducement consistent with the liberal policy adopted in the government of the placers, is equally applicable and should be extended to them.

[To be continued.]

ART. II.—THE OLD BRISTOL COPPER MINE, CONNECTICUT.—BY CHARLES SAMUEL RICHARDSON, MINING ENGINEER.

WHOEVER may lay claim to the honor of discovering the copper mines of Bristol, very little credit is due to those who conducted the mining operations, until quite recently. From what information I can gather in the neighborhood, I learn that, about fifteen years ago, one Mr. Miller, with a few friends, opened on some lodes in the northern part of the township of Bristol: they were led to explore here from certain unmistakable surface mineral indications in the mica slate. It appears they drove a shallow adit level on one of the small lodes into the hill a short distance, and when it was found productive followed down the shoot of ore as far as they could, until their progress was impeded by the water. This system of stoping underhand, of course, did not pay; but it led to the discovery of the great lode. Here they appear to have sunk a large pit, and drove out shallow levels in several directions; some of the work raised must have been very rich, as the deads that remain will pay for stamping; the cost, however, in the end overbalanced the value of the produce of the workings, and the mine was suspended.

The mine was next worked by Messrs. Ives and Company, of Hartford, who greatly extended the underground working and returned a large quantity of ore. It is said they made a considerable profit, but if I may judge from the manner in which the workings were conducted I should feel much inclined to doubt such a result; however, they sold the property eventually to Doctor Mott and Company, who are the present proprietors. Aided by ample capital, nothing was now in the way of proving the mine: an engine shaft was sunk 40 fathoms, steam-engines erected, levels and cross-cuts driven, and nearly $200,000 worth of rich copper ore extracted. The history of the workings during the past seven years are so well known to the mining public that I need not recapitulate them. They consisted of a series of expensive experiments, which absorbed all the profits derived from the mine and involved the proprietors in heavy losses. This must have been very disheartening and at the same time injurious to the mining interests generally; for if a rich mine would not pay for working, how could the public look for profits from poor or doubtful mines? About four years ago the mine passed into the hands of Mr. H. H. Sheldon, as manager for the proprietors. As a prudent man, he considered the best way to work the mine properly would be to engage the services of those who understood the nature of such ground as he had to contend with; he was fortunate in selecting Captain Williams, from Cornwall. Captain Williams had been many years engaged in the heavy ground of our Western tin mines, and understood timbering in

every kind of form: he had now got his hands full. A great deal of credit is due to Mr. Sheldon, whether the proprietors of the mine know it or not; for, at the time he took the entire management of the concern, the 30 and 40 fm. levels were full of water, the bottom lift drawn to grass, and in consequence of the soft nature of the ground, hundreds of fathoms of levels were run together; in fact, the greater part of the old workings were crushed in; all the rich courses of ore, except a few arches, were taken away above the 20-fm. level as far as could be seen at this time, and the mine presented altogether a very uncheering aspect; indeed, the old mine had been condemned by almost every one—geologists, agents, and miners; and said to be a mere bunch—that it was worked out. Capt. Williams, however, thought different: like an old tinner, he tried the mine with a shovel; the van made was quite to his satisfaction. Where there had been such a large quantity of ore taken away, as a Cornishman calculates, some little must remain; sure enough, he was quite correct. The mine was at this time not producing one ton of copper per month. Mr. Sheldon's first operations consisted in reducing the monthly expenditure: he pulled down and sold the steam-engine, which was being driven at a cost of $300 a month; in its place he erected a powerful water-wheel, dropped the lift again to the 40-fathom level, (which is the bottom of the mine at the present time,) and forked the water, put up 18 heads of stamps, reconstructed the jigging machinery, arranged the crushers to the new water-power, and set the surface works in a fair shape to return the ore, when he could get it. They now went below, and for a period of two years were incessantly engaged in clearing out the old runs, timbering old levels, securing ground, and generally making good damages caused by the mine having been full of water. As soon as the mine commenced to throw up lode stuff, it was found necessary to increase the power, as much of the stuff was very poor. To effect this object, a new 38-feet pumping water-wheel, 12-feet breast, was constructed, and placed down in the valley 1300 feet below the mine: it is connected by means of flat rods. The mine at present is drained by three lifts of 8-inch pumps, with a 4-feet stroke, going 12 strokes per minute; it keeps the water very well in dry weather, but is inefficient whenever a flush comes. The new pit-work provided for the new water-wheel is 12-inch, and will be provided with plungers; this is intended for a new engine shaft, which will be sunk from the surface, and put down so as to take the lode at the 60 or 70 fathom level—the old engine shaft is very small, in fact it is more fit for a house-well than the working shaft of a mine.

The mine is situate under the southern slope of a small mountain, of about 500 feet high, composed of gneiss and mica slate rock; the valley or plain below is entirely red sandstone and con-

glomerate. From the mountain sides are found numerous small veins running into the valley: some of them may be called good lodes—in fact, they are so, for they have regular walls; one of them is 3 feet thick, and composed of black oxide of iron and manganese, stones of yellow ore, interspersed occasionally with spots of purple copper; they are all more or less composed of carbonate of lime, felspar, flookan, mundic, and yellow copper pyrites, peach, and capel: all these small veins are at right angles to, or caunters with, the main lode.

The main lode appears to run parallel with the range of the mountain, which is about 35° north-east; at those parts where it can be examined, it averages about 80 feet thick, 22 feet of which is composed of micaceous and felspathic flookan, and 68 feet of black and gray gneiss, mica slate, and black shiny shale; it has a well-defined wall on this side, dipping at an angle of about 50°; on the flookan side it is overlaid by the sandstone; the flookan part of the lode is widening as it goes down. The engine shaft is sunk entirely in the sandstone; but at the 40-fm. level it has just intersected the lode on the flookan side. The question at issue now is—Is it a lode, or is it a mere bunch—a deposit? I am of opinion it is a lode of great magnitude; and the reason why it has made so rich at so shallow a depth is, that the small lodes and branches running from the mountain directly into the flookan have, by infiltration, deposited their mineral products against its side, the flookan, itself, being impervious to water, or nearly so, caused the mineral water to percolate through the more porous parts of the lode; in fact, that is quite evident, for where a run of black gneiss, which is very hard, crosses and forms an intersection with the flookan, it invariably carries a rich leader of ore; again, the black gneiss is generally bounded by the gray gneiss, or soft mica-slate, both of which are absorbents, and are, consequently, highly mineralized for a considerable distance from the branch. The stratum of the solid part of the lode is very irregular, the dip and bearings are at every conceivable angle, yet in the veins that traverse it there is an average parallelism perceptible, although at first sight everything seems confused.

But what to me, and perhaps to every practical mining man from the old country, appears to be a most remarkable geological phenomena, is, that in the very centre of the lode are masses of granite—solid quartzose rock, not mere boulders, but rocks 50 feet long, 40 feet thick, and 80 feet deep, in a kind of diamond shape, with their apex pointed downwards. Against these rocks are generally found a vein of solid ore, and the rock itself for two feet in carries thin films of vitreous copper, very rich indeed. Where the black gneiss approaches these granite rocks, there is found a rich mineral channel of ore-bearing ground; this ore is of the bell-metal and purple kind, and produces about 65 per

cent. for copper. The compact gneiss, or, as I have here, as a mark of distinction, called it, the black gneiss, is similar in texture to graywacke; there is often ranging with this bands of stripiy gneiss, which is composed of alternate layers of gneiss and quartz; the stratum is mostly vertical. Near this there is found a joint or slide, and then against it, in an adverse line of stratum, is found the common mica slate; here is always found, if the line of cleavage is opposed to the line of main lode, a rich vein of solid ore; hence I infer that the minerals in solution, percolating through a softer medium, are arrested, and deposited in the crevices and against the sides of the harder or more impervious rocks. Now, as regards the flookan itself, to a certain extent it may be said to be non-absorbent, but it is not wholly so, for I find that it contains runs of a false flookan, or, in other words, a shaly micaceous clay; this is found to be very metalliferous. During my stay at the mine, several samples were tried from various parts of the flookan, and they gave an average of 3½ per cent. of ore, and the produce of the ore gave 30 per cent. for copper. From the mica-slate in the vicinity of the black shale, a good many vans were made: the average was over 5 per cent. for ore, with a produce of 50 per cent. for copper. Through the whole lode, which, as I have said before, is over 80 feet wide, the ore is finely disseminated; it is good stamps' work, and will amply repay the returning cost. Where the veins and droppers occur—and they are not far apart—the ore is solid, from 1 to 5 inches thick; where vughs occur, the ore is very rich. In the latter stage of the old workings little more appears to have been done than picking the eyes out of the mine; for unless the ore was very rich it was not sent to grass. I form this opinion from seeing thousands of tons of good orey ground still standing in the old stopes and levels, and in one of the old backs I found the stull pieces placed on a course of solid ore.

The produce of the mine consists of yellow sulphuret, purple ore, vitreous ore, copper crystals, or copper glance. The yellow ore, I think, will be found on assay to produce from 15 to 25 per cent.; the variegated, or brown bell-metal ore, 45 per cent.; and the vitreous, from 35 to 75 per cent. for metallic copper.

My inspection of the mine was in the month of February last. At that time there were only 4 miners underground, above the 30-fm. level, and this small corps were throwing up above 18 tons of rich ore per month; in the subsequent two months, six pickmen, above the 30-fm. level, broke and sent to grass nearly 45 tons of copper ore. The crop ore from the jigging hutches produced 41 per cent. and the slimes from the trunking machines and buddles 18 per cent., making an average sampling of 29½ per cent.; and yet this very mine, which has produced this ore, has been condemned over and over again as a mere deposit, and

not worth working. What is the cause, the Old Country miner would ask? The answer will become very plain if he stops a little while in New York—for there he will find that the great bulk of the American mining community are not old miners. If they can find a sett somewhere down in North or South Carolina, Georgia, Virginia, or Tennessee, that produces rich specimens on the surface, away they go, and create a great noise about the immense wealth of their southern mines, but very little is heard about the monthly return, rich as ever they may be. Now, they have finer mineral properties within four hours' ride of New York, than in any other part of the northern United States. I have never yet seen, or ever heard any person say they knew of any mine that can throw up 20 tons of ore, worth $175 per ton, with half a dozen miners. Here, at the old slighted Bristol Mine, there is enough ore-ground now in sight without sinking a single fathom, to profitably employ 100 hands for five years to come, besides having three known lodes in reserve that have never been worked upon at all.

I estimate that within the eastern and western limits of the sett above the present 40-fathom level, there is above three millions worth of ore now discovered, which can be returned, with judicious management, at a profit of above $500,000.

I look upon this mine in no other light than an Australian Burra Burra, or an English Devon Consols. The management is in good hands, and great results in due course of time may be expected. I think it probable that, in the course of the summer, I shall be able to give a more detailed description of this very interesting property; at present, my views are somewhat cursory, yet, so far as they go, they are substantially correct.

Art. III.—MINING OPERATIONS IN THE PROVINCE OF HAINAUT, BELGIUM.

The province of Hainaut is on the frontiers of Belgium. It is bounded west and south by France, and on the other sides by Brabant, Flanders, and Namur. It is subdivided into three arrondisments, the principal towns of which are Mons, Tournay, and Charleroi. Mons is at the head of the canal to Conde, by which it communicates with the Scheldt, and on a branch of the Belgian railway which joins the French line of Valenciennes. There are numerous coal mines in its vicinity, at the villages of Jemappes, Framienes, Warquignies, Hornu, and Bossu. Charleroi is twenty-three miles east of Mons. Its population is employed in extensive coal mines, iron foundries, &c.

The mining operations of the province are under the supervision of a public board of directors, of which M. J. Gouot is

a director and engineer in chief. Through the favor of M. Guillaume Lambert, also an engineer, and member of the board, and commissioner from Belgium to the New York Exhibition of Industry in 1853, we have received the annual report of the chief engineer on the mining operations of the Province, together with other documents of much interest. The report is chiefly as follows:—

Having in my report for the last year presented the results of the coal mining operations from 1838 to 1852 inclusive, I shall now content myself with a brief review of the operations for the year 1853.

COAL MINES.

The working of coal mines in the Province of Hainaut, reached a degree of prosperity in 1853 surpassing that of all previous years, and such as could not have been anticipated four or five years ago. It employed 39,382 workmen, of whom 30,063 were occupied underground, and 9,349 at surface. The wages of these 39,382 workmen, according to the civil statistics, was 23,272,453 francs, or 591 francs per man. The lowest wages of a workman, in 1852, calculated according to three-fifths of the total expense, has been 587 francs; had it been founded like the wages for the year 1853 upon the data of mining, it would have amounted only to $\frac{19435158}{37764}$, or 514 francs. That is to say, the lowest wages of a miner in 1853 would have exceeded the same for 1852 by 77 francs. The lowest wages for the year 1853, determined as in the preceding years upon the three-fifths of the total expense, would have been 632 francs; that is, it would have exceeded that of 1852 by 45 francs.

In 1853 the price of producing a ton of coal, all expenses included, has been $\frac{157}{100}$ francs, and the general price of selling 8.72 francs difference, or mean profit 1.15 francs.

The yield of 217 pits has been 5,482,771 tons, or 61,982,555 *hectolitres* of coal of all kinds, valued at 47,800,280 francs.

This amount, which exceeds that of 1852 by 248,125 tons, or 2,834,787 *hectolitres*, is distributed among the three principal coal tracts (*charbonnages*) of the province as follows:—

Mines at the west of Mons, ...	2,475,577 tons.
" the centre, ...	965,488 "
" of Charleroi, ...	2,041,706 "
Total, ...	5,482,771 "

It should, however, be noticed that the portion assigned, from the statements of the miners, to the mines of the centre, appears quite too low, since it will be less than the yield of 1852 by 64,989 tons, whilst by combining the amount of coal sent by the canal from Charleroi to Brussels, and by railway from Mons to Manage, without estimating the coke, it is evident that the amount sent forward for the year 1853 exceeds that of the preceding year

by 16,629 tons. In 1853, the number of tons sent by canal was less, while that sent by railroad was greater than in 1852.

The product of 1853 is divided into sorts and qualities nearly as is indicated in the following table:—

	Hectolitres.	Tons.	Value Francs.
1. Gaillette, . .	1,779,913	143,842	2,596,596
2. Gailletteries, . .	5,578,037	295,084	4,703,375
3. Fine, . . .	9,657,491	861,730	4,990,700
4. Coarse coal, . .	907,879	81,709	1,176,888
5. Forge gailletteuses or coal,	42,382,354	3,769,537	32,830,066
6. Other kinds, . .	3,676,881	330,919	1,502,660
Total, . .	61,982,555	5,482,771	47,800,280

	1st District. Tons.	2d District. Tons.	1st Direction. Tons.
1. Poor coal, called *terre houille*,	——	23,432	23,432
2. " " with a small flame, .	66,431	459,802	526,233
3. Semi-bituminous, . . .	868,632	1,510,985	2,374,617
4. Bituminous, excellent for coke,	386,311	508,587	894,898
5. Coal blazing, called *Flénu*, .	1,663,591	——	1,663,591
Total, . . .	2,979,965	2,502,806	5,482,771

The export of coal to France during 1853, reached 2,112,014 tons; the shipments of unscreened coal and of coke by the canal from Mons to Conde, by the Sambre branch, and by the railroad, reached 2,091,805 tons. Thus the Province of Hainaut has furnished almost entirely the amount of this large exportation.

The chief results of the coal mining operations are embraced in the following tables:—

Coal mines, 1853.		1st District.	2d District.	1st Direction.
Pits of		86	45	81
Mines in operation, ...		100	117	217
" in reserve, &c., &c., . . .		33	66	99
Total, ...		169	228	397
Steam engines for pumping,	No.	39	42	81
	horse power,	6,262	3,744	10,006
Steam engines for hoisting, pits in operation,	No.	102	94	196
	power,	3,972	3,037	7,009
Steam engines for hoisting, " in reserve,	No.	31	40	71
	power,	1,005	1,204	2,209
Steam engines for ventilation,	No.	41	56	97
	power,	586	643	1,229
" " for various uses,	No.	9	7	16
	power,	90	168	258
" " of all kinds,	No.	222	239	461
	power,	11,915	8,796	20,711
Horse machines,	No.	——	22	22
	power,	——	35	35
Workmen of all kinds, underground, . . .		18,084	11,979	30,063
Workmen of all kinds, at surface, . . .		6,062	3,257	9,319
Total, ...		24,146	15,236	39,382

		1st District.	2d District.	1st Direction.
No. of horses,	underground,	324	337	661
	at surface,	360	222	582
Total,		684	359	1,043
Expense of works preparatory and extraordinary, francs,		2,408,259	3,534,300	5,942,559
Total expense, ordinary and extraordinary,	Salaries,	13,485,801	9,786,652	23,272,453
	Other expenses,	10,109,337	8,128,088	18,237,425
Total,		23,595,138	17,914,740	41,509,878
Product, Quantity,	hectolitres,	34,173,594	27,808,961	61,982,555
	tons,	2,979,965	2,502,806	5,482,771
Value,	francs,	27,538,316	20,261,964	47,800,280

As in the reports of former years, so there is given in this, statistical tables relative to the different branches of mining industry. For the year 1853 there is added a table relative to the working of quarries which the engineers have omitted to furnish since 1850, in consequence of the expenses of visiting having been withheld.

OPERATIONS IN IRON MINES.

		1st District.	2d District.	1st Direction.
No. of open mines,		18	—	18
" underground mines,		—	161	161
" of workmen,		268	942	1,210
Iron ore extracted,	Raw, tons,	52,800	182,024	234,824
	Washed, "	44,000	110,300	154,300
Value at mine, francs,		345,500	975,789	1,321,289

QUARRIES.

		1st District.	2d District.	1st Direction.
No. of quarries,		205	211	416
" in operation,	open,	156	192	348
	underground,	43	6	49
Steam engines for hoisting and pumping,	No.	53	6	59
	Power,	920	65	985
No. horses,		390	67	457
" workmen,		5,691	1,489	7,180
Value of product, francs,		5,636,135	1,201,358	6,837,493

SMELTING WORKS.

1. Coke Furnaces.

		1st District.	2d District.	1st Direction.
No. blast,	in operation,	2	21	23
	suspended,	—	9	9
Total,		2	30	32
No. coke ovens,		100	480	580
" workmen,		275	1,833	2,108
Consumption,	Iron ore, tons,	26,774	342,288	369,062
	Stone, "	15,003	130,547	145,550
	Coke, "	13,753	161,102	174,855
Product in pig,		7,646	111,227	118,873
Value, francs,		724,804	11,562,390	12,287,194

2. Charcoal Furnaces.

Number,	in operation,	—	—	—
	suspended,	—	6	6

COAL AND CHARCOAL REFINERIES.

		1st District.	2d District.	1st Direction.
Open hearths, Refineries,	in operation,	—	8	8
	suspended,	—	14	14
Reheating,	in operation,	—	4	4
	suspended,	—	4	4
Puddling ovens,	in operation,	7	103	110
	suspended,	1	18	19
Reheating ovens,	in operation,	4	42	46
	suspended,	1	16	17
Number of workmen,		210	1,866	2,076
Consumption,	Pig, tons,	6,865	66,729	73,594
	Charcoal, tons,	——	1,620	1,620
	Coal, "	10,100	121,468	131,568
	Coke, "	——	——	——
Product of iron,		5,720	49,088	54,808
Value, francs,		1,201,200	10,290,246	11,491,446

PLATINERIES, HAMMER AND SLITTING MILLS.

Reverberatories,	active,	5	8	13
	suspended,	—	4	4
Open hearth,	active,	7	22	29
	suspended,	—	8	8
Workmen,		34	150	184
Consumption,	Iron, tons,	——	1,320	1,320
	Coal, "	1,097	3,023	4,020
Product,		463	2,383	2,846
Value, francs,		162,050	830,990	993,040

IRON FOUNDRIES.

Foundries,	active,	16	23	39
	suspended,	1	3	4
Reverberatory ovens,		—	2	2
Workmen,		146	433	581
Consumption,	Pig, tons,	3,209	14,459	17,668
	Coke, "	781	3,700	4,481
Product in cast iron,		2,987	13,426	16,413
Value, francs,		682,235	2,355,587	3,037,822

GLASS HOUSES.

Establishments,		5	34	39
Melting furnaces,	active,	5	68	73
	suspended,	3	11	14
Crucibles,	active,	36	493	529
	suspended,	23	74	97
Workmen,		190	2,934	3,124
Consumption of coal,		8,136	145,010	153,146

GRAND TOTAL.

Workmen,	855	7,218	8,073
Consumption of coal, tons,	43,466	541,170	587,636
Total value, francs,	3,352,859	35,911,243	39,264,102

No account has been taken this year, as in previous reports, of the statistics of lead, for the reduction of which there are three furnaces, employing ten laborers, and yielding in 1853

only 503 tons of lead, valued at 226,350 francs; nor of the zinc works, which have been, however, suspended during the year.

On a review of the last table it will appear that the entire number of workmen engaged in the establishments of the province, the consumption of coal, and the gross product, exceed 1852 by 1,826 workmen, 136,192 tons of coal, and 13,755,947 francs. Of this greater value, 5,887,965 arises from the coke furnaces, 4,330,256 francs from the refineries, and 2,595,260 francs from the glass works.

The total rents of the mines in 1853 amounted for the 1st district to 107,457,99 francs, 2d district 47,931,02, total 155,389,31 francs.

The accidents which have happened in the mines during 1853 may be divided into ten classes:—

	Accidents.	Wounds.	Deaths.	Wounds and Deaths.
Accidents during descent or ascent with ropes,	19	3	29	32
" " " " " ladders,	6	1	5	6
Accidents under other circumstances,	14	—	14	14
Falling of rocks, &c.,	34	6	31	37
Blasting,	1	2	1	3
Explosions,	3	1	2	3
Collisions of cars on inclined planes,	8	2	9	11
Accidents from various causes,	9	2	9	11

Thus it appears that the vicious, unwarrantable use of ropes for descent into the mines continues to be disastrous to the miners of the 2d district.

During 1853 a single explosion only occurred in the mines, which occasioned only one death. As compared with 1852 the number of wounded and dead decreased 129.

The report closes with urging the importance of maintaining strict regulations for the proper ventilation of the mines.

ART. IV.—MODE OF TREATMENT OF ORES AT THE MINES OF SCHEMNITZ, IN HUNGARY.* FROM A TOUR IN HUNGARY BY THE ENGINEERS RIVOT AND DUCHANOY.

BEFORE making known the actual production of the mines of Schemnitz, we will describe rapidly the mechanical preparation of the minerals. The mines produce several species of minerals, which may be distinguished as follows:—

1st. Galena slightly argentiferous, accompanied with quartz, limestone, baryta, and a feldspathic rock more or less impregnated with iron pyrites.

* Translated from the *Annales des Mines* for the Mining Magazine.

2d. Minerals especially argentiferous, which present themselves in patches or in veins, disseminated in a feldspathic, quartzose, or pyritous matrix.

3d. Auriferous quartz or cinnople ordinarily mixed with the other species and especially with the first.

The minerals mined are divided into minerals and *menus* (the debris of the operations). The first are broken into pieces sufficiently small that selections may be made according to their nature and quality. These operations produce,

1st. Minerals proper to melt, as lead, silver, gold.

2d. Minerals for the stamping mill, in pieces: also, divided into lead ores, silver ores, auriferous ores or mixtures.

3d. Menus coming from the breakage, and for which they adopt also, according to their source, the distinction of *menus* plombeux, argentiferous, or auriferous.

4th. Sterile pieces which are thrown away.

The sterile matters come principally from the sorting of the ores which contain galena as the only useful mineral. Those which contain cinnople, and silver ores, ordinarily disseminated in very fine particles in the gangue, do not furnish sterile matter, and the matters extracted ought all to pass to the *menus* for mechanical preparation. The rich ores of lead and silver are treated separately in shops near the places of breakage and sorting.

They are crushed sufficiently fine to pass to the metallurgical treatment. The rich auriferous minerals are, on the contrary, pulverized very fine, and submitted to amalgamation. By this, a large proportion of the metallic gold is withdrawn, the residue is sent to the place for mechanical preparation at the same time with the poor auriferous minerals.

The *menus* of the mines, the *menus* of breakage, and the minerals for the stamping mill, are sent to the shops of mechanical preparation, in which the useful matters are to be separated from them. Each stamping mill receives, as nearly as possible, the same quality of ores, in order that the work and the results may be regular.

The apparatus employed in the different shops depends on the nature of the ores to be treated, &c., &c. [For the details of these, see the memoir published by M. Pache, in the Annales des Mines, 4th series, book 10, page 595.] We limit ourselves at present to a rapid exposition of the series of operations.

OPERATIONS.

Several of the veins, principally the Grunergan, yield ores so argillaceous, that it is necessary before stamping them to submit them to a cleansing. The operation is performed in a large *trommel* with double conical sides, the invention of M. Rittenger. After the washing, the minerals deprived of the clayey matter, are treated the same as those ores for which this operation was

not necessary. We will take, for example, auriferous minerals, which require operations the most complicated.

The minerals are at first stamped very fine under water, which water is finally conducted in the *moulins á or* (gold mills), and upon inclined cloths, which retain a part of the metal. The matters arrested upon the cloths, should be subjected to a special operation on the *caisson á or.*

In the mills, the precious metal is partly retained by the mercury, which it is necessary to submit after a certain time, to distillation. On leaving the mills, the sand and mud are conducted into the apparatus of classification, and labyrinths, and finally into the basins of depot. By this is produced four classes of sand and mud, which are concentrated finally on the *tables á secousses,* or on the *tables dormantes.* The concentration on the tables produces auriferous mud, which passes in part to the *caisson á or.*

STAMPING.

Let us review now each of these operations. All the ores are stamped under water, and reduced into very fine sand, under very heavy pestles. This mode of stamping produces a large quantity of mud, and in consequence, is one of the principal causes of the enormous loss of metals which the method of mechanical preparation entails. It is, nevertheless, the only one which can be employed, at least for the most part of auriferous and argentiferous minerals. In reality these minerals contain, in general, gold and silver; the first, especially, disseminated in the gangue in very fine particles, and almost indiscernible; moreover, it has, for a long time, been recognized as indispensable to extract the greatest possible proportion of gold, by the mechanical process, on account of the loss produced by the metallurgical treatment. For this, it is necessary to reduce all the auriferous minerals into very fine powder, in order to disengage the particles of gold, and bring them to a state in which they can be absorbed by the mercury of the mills.

A *moulin á or* (gold mill) is composed of two parts, the cistern in cast-iron, in which is placed the mercury, and the wooden wheel armed with shut iron teeth, which almost touches the surface of the mercury. The mills are conjugate, that is, the sand passes successively in two mills, and is in consequence put twice in contact with the mercury. The matters going out of the stamping mill, pass first through a grillage or grating which retains the pieces of straw, wood, &c., and are then conducted into the first mill (entering by the middle and going out by the spout of the cistern), pass finally to the second mill, which is on a little lower level, and then pass on the inclined cloths. (The mill referred to, consists of a cast-iron conical-shaped cistern, about two feet diameter, and eight inches deep, and in which the mer-

cury is put. The wheel is composed of a large block of wood shaped on the outside nearly to fit the interior of the basin in which it sets, and furnished on its under side with teeth which nearly touch the surface of the mercury. This wheel has a large hole through the centre, flaring out at the top like a funnel, into which the sand and water flows finally to pass out by a spout near the top of the basin, into the next mill.

In this rapid contact with the mercury, only a part of the gold can be retained, and form an amalgam; the rest escapes with the sand and water. They have made, and do yet make experiments on the best disposition to give to this apparatus.

They have tried large and small mills, containing respectively, fifty-seven pounds, and twenty-eight pounds of mercury. The small mills appear to give the best results, or rather retain the largest proportion of gold—a proportion yet which does not surpass twenty or twenty-five per cent of the whole amount of gold in the sand. The mills work without interruption during a time which varies with the richness of the ores, from three to four weeks. At the end of this time, the mercury is taken out, submitted to a strong pressure in sacks of cloth, and finally the amalgam is distilled. The loss of mercury is very small. The inclined cloths, upon which pass all the sand in coming out of the mills, retain a proportion of gold (from ten to fifteen per cent. of all the metal contained in the sand originally), and at the same time the portion of the sand the most heavy. These are removed once a day, and washed in large cisterns. The depots of these cisterns is concentrated in the *caisson á or*, which we will speak of farther on. The sand and mud, still containing at least two-thirds of the original amount of metal, pass in a series of little canals, of which the *ensemble* is known as the *labyrinth*, disposed in such a manner that the movement of the water becomes slower and slower. They determine by this the deposit, first, of the largest and heaviest parts of the sand, finally, in succession, of the sands of mean size, the fine sands, and the mud. The basins of deposit, placed in some shops at the end of the labyrinths, gather a certain part of the finest portions of the mud. All the rest escapes with the water, and is lost. The classification produced is necessarily very imperfect, and the names of coarse sand, mean sand, fine sand, can only be applied in a relative manner. These different grades of sand are afterwards submitted to treatment on the *tables á secousses* and *tables dormantes*, and the pyritous parts, those containing lead, gold, silver, and their mixtures, &c., are separated, all of which are afterwards subjected to separate treatment. This separation takes place by allowing the sand and mud, mixed with water, to flow on the tables very slowly—the tables at the same time being kept in slight agitation. When they are finally filled with the deposit, it is found that certain parts contain almost exclusively galena,

other parts gold, &c., mixed, of course, with sand, but their position being determined by their specific gravity. These operations require much skill and experience in the workmen, and are described in detail.

[To be continued.]

Art. V.—THE BLOW-PIPE, AND ITS USE IN CHEMICAL ANALYSIS. —No. IV.*

3. TEST ON CHARCOAL.

By heating on charcoal, the observations made are very similar to those by the treatment in the glass receiver. It is of particular importance to become acquainted with the colors and some other properties of *sublimates*, which are found on the coal, if certain substances are heated on it. The following comparison, borrowed from Plattner's "Probirkunst mit dem Löthrohre," gives the particulars thereof.

a. Selenium smelts very easily, and gives in the oxidating and reducing fire a brown smoke, and also a short distance from the test a steel gray, faint metallic shining sublimate, which is, at a greater distance, dark gray and somewhat violet. This sublimate is pretty easily removed from one place to another by the oxidating flame; and if blown at with the reducing flame, it leaves its place with a fine azure blue tint. While selenium is smelted on coal, or its sublimate, formed thereby, is touched by the flame of the blow-pipe, a strong smell like that of foul radish is perceptible, which appertains to the gaseous and colorless escaping oxide.

b. Tellurium smelts very easily, volatilizes with smoke, and produces on the coal in the oxidating and reducing fire, at no great distance from the test, a sublimate of telluric acid. The sublimate is white, but has a red or dark yellow border; it can be removed by the oxidating flame from one place to another, and if blown at with the reducing flame, it disappears with a green, and on the presence of selenium, with a bluish green brilliancy.

c. Arsenic volatilizes without smelting first, and sublimates on the coal, in the oxidating and reducing fire, arsenious acid. The sublimate is white, in thin sheets grayish, and at a distance from the place on which the test was put. It is again forthwith removed by a mere warming with the blow-pipe flame. If hastily blown at with the reducing flame, it disappears with a faint light blue tint. By the volatilization a strong smell like that of garlic is perceivable, which is peculiar to the sub-oxide of the escaping arsenic.

d. Antimony smelts very easily, and in the oxidating and reducing flame it covers the coal with oxide. The sublimate is

* Continued from Vol. II., No. 2, page 158, Mining Magazine.

white, in thin layers bluish, and nearer the test than the sublimate of arsenious acid. By a moderate heating with the oxidating flame it can be removed from one place to another without giving a colored tint; but if exposed to the reducing flame, it changes its place with a faint greenish blue blaze. As the sublimate of oxide of antimony is not so volatile as that of arsenious acid, both sublimates are very easily distinguished.

If metallic antimony is smelted on coal and exposed to a red heat, and if then the blowing is interrupted, and the coal with the fusing metal globule quietly put down, the latter remains for a long time in glowing fusion, and thereby produces a thick white smoke, which partly sublimates on the coal and finally around the globule in white crystals, shining like mother-of-pearl. This phenomenon is founded upon the fact, that the red-hot fusing metal globule absorbs oxygen from the atmosphere, forming oxide of antimony, and that thereby so much heat becomes free as is necessary to keep the easily smelting antimony for some time, and indeed so long as it is not covered yet with crystals of oxide, in a red glowing fusion.

e. Bismuth smelts very easily, and in the oxidating and reducing fire it covers the coal with oxide. The sublimate is, as long as hot, of a dark orange yellow; after cooling, citron yellow; and in thin films, bluish white. The yellow sublimate consists of pure bismuth, and the bluish white sublimate, which is farthest distant from the test, of carbonate of bismuth. The sublimate of oxide of bismuth is not quite as far from the test as the sublimate of oxide of antimony. It is removable by either blow-pipe flame from one place to another, as the oxide of bismuth on the glowing coal becomes reduced, the reduced bismuth forthwith again volatilizes and thereby reoxidizes; it has, however, not the property to leave its place in the reducing fire with a colored blaze.

f. Lead smelts easily, and in the oxidating and reducing fire it sublimates oxide on the coal in the same distance from the test as bismuth. The sublimate is, while hot, dark citron yellow; after cooling, sulphur yellow; and in thin films, bluish white. The yellow sublimate consists of pure oxide of lead, and the bluish white of carbonate of lead. If the yellow sublimate is heated with the oxidating flame, it changes its place for the same reason as oxide of bismuth, and without giving a colored tint; but if the reducing flame is used, it leaves its place with an azure blue blaze.

g. Cadmium smelts easily, ignites in the oxidating fire, burns with a dark yellow flame and a brown smoke, whereby the coal pretty near to the test becomes coated with oxide. This sublimate shows its peculiar color most distinctly after its entire cooling; it is red brown, and in thin films, orange yellow. The sublimate of oxide of cadmium is removable with either flame, as the

oxide of cadmium is pretty easily reducible, and the metal volatile; but it gives thereby no colored tint. From the outward border of the sublimate the coal appears sometimes filmed with peacock colors.

h. Zinc smelts easily, ignites in the oxidating fire, burns with a luminous greenish white flame, and a thick white smoke, whereby oxide is sublimed on the coal. The sublimate is pretty near to the test; it is yellow while hot, and white after cooling. If heated with the oxidating flame, it glows, but cannot be volatilized, as the glowing place of the coal, where it lies, is not sufficient to cause a reduction. Even by application of the reducing flame the volatilization takes place slowly.

i. Tin smelts easily; in the oxidating fire it becomes covered with oxide, which can be mechanically blown off; in the reduction fire the fused metal obtains a bright surface and films the coal with oxide. The sublimate is, while warm, of a faint yellow, and pretty strongly glowing if exposed to the oxidating flame; while cooling it assumes a white color. It lies quite close to the test, and is not volatilized by either flame.

k. Molybdenum, in powdered form, cannot be smelted by the blow-pipe; but if heated with the outer flame it gradually becomes oxidized, and, at a small distance from the test, films the coal with molybdenic acid, which at many places, and particularly nearest to the test, sublimates in transparent scaly crystals, but besides in powdered form. The sublimate, as long as it is hot, has a yellowish color, but grows white by cooling. The crystal scales are most nicely formed the further one can remove the test from the point of the blue flame and keep it hot enough. The molybdenic acid, crystalline as well as in powdered form, sublimed on the coal, can be removed with either blow-pipe flame; the place, however, which it leaves, appears after entire cooling of a dark copper red and of a metallic lustre, from the remaining oxide of molybdenum which is formed by reduction of the molybdenic acid that came in contact with the glowing coal, and which cannot be volatilized. In the reduction fire the metallic molybdenum is unchangeable.

l. Silver, if it is by itself uninterruptedly kept fusing in a strong oxidation fire, it films the coal quite faintly dark red with oxide; if in connection with a little lead, there appears first a yellow sublimate of oxide of lead, but subsequently, when the silver gets free from the lead, the coal beyond the yellow sublimate becomes a dark red color. Silver containing some antimony, first causes a white film of oxide of antimony, which, however, by continued blowing, becomes reddened. Silver containing some lead and also antimony, produces, after the greatest part of the lead and antimony are volatilized, a strong crimson red sublimate. Such a sublimate is sometimes obtained by testing rich silver ores for themselves on coal.

m. Sulphurets, Chlorids, Bromids, and *Iodids.* In blow-pipe experiments one has not always to do with pure metals, which if not entirely unchangeable by fire, may be detected by their sublimates; but sometimes, also, with combinations, which on coal sublimate with a white film, that can be again removed with the oxidating flame, and very often resembles the sublimate of oxide of antimony. This is, among the sulphurets, the case with *sulphuret of potassium* and *sulphuret of sodium*, which, while they are formed on coal, in the reducing fire, from the sulphates, produce a white film that is not very volatilizable, and consists of a neutral sulphate. Such a sublimate, however, is not formed until all the sulphate has penetrated the coal and given off its contents of oxygen. As sulphuret of potassium thereby appears more volatile than sulphuret of sodium, a sublimate of the former is earlier obtained than of the latter, and also in a thicker film. When such a sublimate is touched by the reducing flame it disappears, if consisting of sulphate of potash, with a blue violet tint, and if consisting of sulphate of soda, with a reddish yellow tint. *Sulphuret of lithium,* formed of sulphate of lithion, on coal in the reducing fire, also volatilizes by a strong heat, but still harder than sulphuret of sodium, and gives an impure white, a grayish white thin film, which disappears with a carmine red tint, if blown at with the reducing flame. *Sulphuret of lead* and *sulphuret of bismuth* produce in the oxidating fire as well as in the reducing fire, two different films, the most volatile of which is of a white color, and consists, from sulphuret of lead, of sulphate of lead, and from sulphuret of bismuth, of sulphate of bismuth. If such a film is blown at with the reducing flame, that of the former metal disappears with a bluish tint, that of the latter without a tint. That sublimate which is nearest to the test, consists of the oxide of the tested metal, and may be detected by its color, in the hot state as well as after cooling. There are other sulphurets, by the treatment of which on coal in the blow-pipe flame, a more or less strong white sublimate is formed, for instance *sulphuret of antimony, of zinc,* and *of tin;* but such a sublimate consists only of the oxide of the metal, and proves by its treatment with the oxidating flame either volatile or unchangeable by fire.

Among the chlorids there are several that possess the property of volatilizing, and form a white film, if heated on coal by the blow-pipe flame, viz., *chlorid of potassium, of sodium, of lithium,* which volatilize and produce a faint film near the test after having, in a state of fusion, penetrated the coal (chlorid of potassium gives the strongest and chlorid of lithium the faintest film, the latter also is not pure white but grayish white); *chlorid of ammonium, of mercury, of antimony,* which volatilize without first fusing; *chlorid of zinc, of cadmium, of lead, of bismuth, of tin,* which first fuse and then produce two sublimates, namely, one white and

volatile from the chloride, and another less volatile from the oxide of the metal. If the sublimated films from the above named chloride are blown at with the reducing flame, they partly disappear with a colored tint, which is bluish, somewhat violet, by chlorid of potassium, reddish yellow by chloride of sodium, carmine red by chloride of lithium, and blue by chloride of lead; the others disappear without showing a tint. *Chlorid of copper* smelts also, and thereby colors the flame intense azure blue. By continued blowing, a part of the test volatilizes with a white smoke, which smells strongly of chlorine; and another part forms on the coal three differently colored films, of which that nearest to the test appears dark gray, the middle one dark yellow or brown, and the farthest one bluish white. If such a film is blown at with the reducing flame, it partly changes its place with an azure blue tint.

Of the bromids and iodids which show on coal quite similar properties with the chlorids, deserve here particularly to be mentioned *bromid of potassium, bromid of sodium, iodid of potassium*, and *iodid of sodium*. They fuse on coal, penetrate the same, and then volatilize with a white smoke, which partly sublimates on the coal rather far from the test. Such a film, when touched by the reducing flame, disappears with a colored tint, which is bluish or violet from bromid and iodid of potassium, and reddish yellow from bromid and iodid of sodium.

[To be continued.]

ART. VI.—THE VENTILATION OF MINES AND COLLIERIES.*—BY JOHN PHILLIPS, F. R. S.

PILLAR WORKING, OR WORKING IN THE BROKEN.

As already explained, the process of working whole coal, by which the roads and air passages are made, leaves the roof supported by rectangular blocks of undisturbed coal. These supports (technically posts or pillars) have, in some cases, remained untouched for very many years; the workings have even been abandoned for a long period (whole working having ceased), and then been re-opened for the extraction of the pillars. In some cases, on re-entering the pit, the pillars were found uninjured, the spaces between them still open, the roof sound, and the floor level. But in general this is not the case after long periods. The roads and other passages are commonly contracted by the closing together of the roof and floor; the roof bends down or breaks, the floor heaves, and the pillars are shaken; a creep affects the whole ground, and in traversing large districts of this kind, we find the stratification arched and displaced in a singular manner.

* Continued from page 15, Vol. III., No. 1.

In a district thus abandoned for a time, which has suffered creep, the coal is injured, and the roadways more or less blocked up; the mine has, in fact, to be won again, with great expense and poor prospect of remuneration.

The ancient notion of pillars was merely that of sufficient props to sustain the roofs, and the practice was to get as much by passages among these props as was practicable, without weakening them too much.

Thus, in a series of pillars, the alternate pillars might be sliced parallel to their length, or shortened at one end, or at both ends; in short, robbed according to the degree which was found practicable. Then came the notion of removing the whole of the pillars by a separate and special working, subsequent to the excavations in the whole coal; and this is now replaced by the method of working in districts, each district containing both whole and broken workings which go on at the same time, but in different parts.

Pillar working has a direct effect on the extrication of fire-damp, and a collateral effect on the accumulation of both fire-damp and choke-damp. Its direct effect is to weaken the ground, to open fissures in, and create falls from, the roof, and to permit partial up-swellings of the floor. By these movements new channels are opened for the escape of gaseous matter, not only from the beds in immediate contact above and below a given seam of coal, but also from any other seam of coals, above or below, to which the disturbing movement may extend. After taking off the first pillars in a new district of the Black Boy Colliery, the roof fell, and an issue of gas immediately took place which fouled an extent of drifts estimated to contain 38,000 cubic feet. No accident followed, and the place was soon cleared by the pure current of air. Most seams of coal on being freshly opened yield a large supply of fire-damp; any fissure suddenly opened to an undrained seam by the movements consequent on pillar-working, may deliver a dangerous amount of fire-damp. This is an obvious source of misfortune, and precautions against it are equally obvious. Drifts may sometimes be driven in the seam above to drain it in manageable portions; boreholes may be made to seams above or below for the same purpose; and the safety-lamp should be in all cases used. Such drifts and boreholes may, indeed, not always prevent a large inrush of gas, because they may not always effectually reach the gas-holding cavities; but they are always valuable as precautionary measures, and are often productive of safety. Though at Hebburn, such borings did not secure the colliery from explosion (1849), they have, for a long time, prevented dangerous eruptions through the floor of the Bensham coal at Willington; for they drain off much fire-damp yielded by a six-inch band of coal, 22 feet beneath that seam, and deliver it regularly and safely into a

strong current of good air which renders it harmless. Even in this colliery, however, unexpected large eruptions have happened since the accident in 1841; and Mr. Johnson, who superintends the works, has had great reason to rejoice that the Davy lamp has been for several years exclusively used. A collateral effect of pillar-working, is the formation of new, large, and irregular spaces for the accumulation of gaseous matter. The roof, when it has fallen in the ruinous heaps which constitute goaf, leaves many irregular cavities, into which the gaseous contents of the mine, pure and impure atmospheric air, fire-damp and choke-damp, sometimes one or the other, and not unfrequently all, enter. This is the state of the goaf, or fallen part of the mine, a state liable to change with fresh falls, and subject to variation in sympathy with the atmosphere.

Whatever be the gaseous matter which fills the goaf, it soon acquires a general internal equilibrium, and would be nearly quiescent, or gently exude, but for the variation of the atmospheric pressure to which its own density is due. That pressure being weakened, the pent-up gases expand proportionally; a great fall of the barometer will be followed by a great tendency of the goaf air to come out; a suddenly great fall will bring it out rapidly; augmented external pressure will drive it inward.

The condition of the goaf cavities thus becomes a matter of great interest and even anxiety. What amount of danger lurks in their mysterious recesses is not always discoverable; and, as a consequence, whether to pass air currents through them or not, is a question of which the practical solution is not uniform. In some collieries (Haswell) the goaves are carefully and rigorously ventilated, by compelling the return air to pass through them; throwing it, after it has done its other work, on the goaf in its way to the furnace. In other cases ventilation of the goaf is disregarded, its edges being however carefully swept by the returning currents, and regularly examined by the wastemen.

VENTILATION. THE AIR CHANNELS.

For the purpose of obtaining clear ideas of the methods now employed in ventilating the collieries of the northern district, we may, in the first place, consider the course or path which the air is made to take underground, and the contrivances by which it is directed; and afterwards the power by which it is urged along.

Commencing at the surface, we remark that a few collieries admit the fresh air by a level or inclined plane, but the greater number by vertical shafts. From one such level or shaft the air is made to pass into one, two, or three seams of coal, according to the peculiarities of the mine; there being, however, very few collieries in which more than two seams are worked at the same time.

When two seams of coal are worked from the same pit, it is generally found best to have a similar plan of works for each seam, the main roads of one over those of the other, and the extent and activity of working in one seam arranged with some regard to what takes place in the other. It will be sufficient for the present purpose to consider the method of ventilation in one seam.

Descending, therefore, to the bottom of the shaft in a large colliery, we find the column of air to run but a very short course before it is divided into two portions, which again suffer successive subdivisions to a limited extent, so as to constitute a definite number of currents or splits of air, each of which is appointed to ventilate a certain district, and then to return by or through the goaf to the upcast shaft. Good reasons can be given for commencing the splitting of the air immediately at, or very near the foot of the downcast shaft. At Hebburn, the main column is divided into four great streams, which rush out in four directions from the ample space surrounding the shaft. This arrangement becomes impracticable when the downcast and upcast shafts are approximate.

At Lyon's Pit (Hetton) three great channels are thus employed; at Haswell, two. Proceeding along one of those great air channels, we remark that it is also always a great road of the mine, along which the main stream of traffic is passing. The air is kept in this channel, and prevented from escaping through the numerous channels which exist to the right and left, by stoppings; usually constructed of brick, 10 inches thick, plastered in front, and sometimes stowed or helped by loose materials piled behind; these are commonly set a little within the opening of the drift which they stop. Such stoppings leak more or less, and for the most part are blown out in a great explosion. They are sometimes made much thicker (4 feet), and then constructed of stone, mortared in front.

Proceeding onward, there will be observed a part where arched brickwork or stonework, or a boarded floor, appears overhead. Here is a crossing of the air currents, one (the return air) being carried over the other (the intake air). In cases of explosion these crossings are mostly destroyed, and even when very strongly made (as with arches on the intake and a wall upon the crown of the arch in the return) do not always resist. When this crossing is destroyed, the return current mixes with the intake, and the ventilation is ruined for certain parts of the mine. To prevent this fatal effect, plans have been devised for allowing parts of the wooden crossings to yield more readily than the rest of the structure, and open a passage for the air, which may be closed again by the falling of this part after the blast has passed by. The stream of air in which we are passing, after giving off one or more branches, is at last stopped by a main door, placed

across the roadway, and set close in its frame to stop all the air, or with a narrow opening or scale, to allow some portion of the air to pass onward, while the rest is turned aside. In more southern collieries we find this purpose often effected by a suspended sheet of tarpaulin. The air which is allowed to pass onward may be for the purpose of ventilating a pair of exploring drifts, while that which is turned aside is destined for a working district.

The course of the air in exploring drifts will be understood by observing that at regular intervals, connections are made by cross-cuts (technically holings) from one drift to the other. These are successively stopped as fresh ones are made. The air is conducted up each drift, beyond the last-made holing, to the face, by a vertical boarded partition (technically brattice), round the end of which the current passes, and then returns to the holing, and so to the other (technically back) drift, where also bratticing is employed. In this way, by dividing each drift, the air can be conducted a certain number of yards, say 30, 60, and much more rarely 100, according to the strength of the current, before a new holing becomes necessary. There can be little doubt that in long air-courses, owing to the great number of stoppings, which are difficult to make air-tight even at first, and the great pressure of air to escape through them by shorter channels to the upcast, there is much leakage and waste of air. This is especially the case in re-opened works, where the ground is much moved. In such cases a greater than ordinary distance between the stoppings has been thought advisable, and is put in practice. It is likely to be most sensible whenever the intake air-stream moves very rapidly, and the main returns are adjacent.

We now enter a working district accompanied by the stream of air which is wholly destined to ventilate it, or, in mining language, has nothing else to do. According to the most approved modern system this district contains a set of workings in the whole coal (bords), and a set of juds or pillar-workings, or workings in the broken. It is a constant rule to carry the air first through the bords, which are commonly worked by candles, and then through the pillar workings, which are, almost without exception, worked by safety-lamps, under the strictest regulation. These two portions of the same working district are kept quite distinct, the access to the pillar-workings being strictly guarded to exclude unprotected lights.

1. We shall first describe the ventilation of bords in a district of whole coal, by an example from Wallsend Colliery.

The air is taken into the district and brought out again by a pair of headways (winning headways), originally communicating with each other at regular intervals. All these communications, except one or more at the farthest extremity, are afterwards securely stopped by brick walls 10 inches thick. One headway

thus becomes an intake, the other a return. In the example before us the intake air is carried by one or more courses frequently inflected, east, north; east, south; east, north; west, north; &c., by all the working faces (which are advancing eastwards), and borne up to these faces by arrangement of stoppings, doors, and brattices, till, after crossing the pair of headways, it reaches the extreme west of the district. It then returns by one or more courses, south, east; south, west; south, east; &c., and finally runs westward, northward; and westward, northward to the upcast pit.

By following the direction of the air stream, it will be evident that not only the bords and headways are ventilated at the points where they are advancing into whole coal, but that currents are taken up and down them, so that nearly every part is swept by the air. This was formerly done by coursing the air in one stream up and down the bords and headways, but now the air is divided into several small splits or minor currents, two or three of which may be observed to flow in the same direction, and then return in a different direction, being guided by stoppings in proper situations. By this process of subdivision, the total distance which any one portion of air has to travel is diminished; the velocity of air in each of its channels moderated; and the total quantity (owing to lessened resistance) augmented. The quantity of air passing along any particular set of working faces can be varied at pleasure by temporary stoppings, and very few doors are necessary in this particular arrangement, which is rendered effective by a column of air amounting to not less than 22,010 cubic feet per minute. This quantity of air has "nothing to do," but to ventilate one district of whole coal, and it returns to pass over the furnace without touching the goaf.

2. Ventilation of juds in a district of broken or pillar working.

As in the case of whole working, the air is taken into the district of pillar working and brought out again, by means of a pair of headways, all but the farthest communications between them being securely stopped. The intake air-course is the horse road. A main door is across it. This allows of the passage of tubs, but diverts the air by several channels to the western boundary of the district, where it flows generally northward, being guided by several stoppings and one door (to allow passage for the road). It is thus carried in full streams to the unequal faces of the pillar workings, and made to flow among the props and through the workings, between the pillars of coal and the goaf.

Thus thrown on the large spaces of the pillar workings, the air presses on the atmosphere of the goaf whatever it be, and some of the air penetrates into the goaf, and re-enters the

regular air channels at the eastern extremity, more or less contaminated by gases derived from the goaf.

The air then returns by somewhat devious courses to enter the upcast shaft by a drift much above, and quite unconnected with the furnace. The quantity of air employed in the case before us is 15,750 feet in a minute. Safety-lamps are used exclusively in the pillar-working.

From what has been said, it appears that in this method working each district is first completely worked in whole, afterwards completely worked in pillar: to each district is given one full separate air current, which, after ventilating the works, returns separate for at least the greater part of the way to the upcast shaft. The return air currents thus brought back are treated according to the district they come from. The pillar air, which, from sweeping by the goaf, may become more contaminated than that which passes in whole coal, is not allowed to go over the fire, but passes by a gas-pipe drift into the shaft at a safe distance from flame. Barriers of unbroken coal are generally left to separate effectually the districts of whole and broken workings. In one, lamps, in the other, candles, are commonly used; but in Wallsend Colliery no candles are allowed; lamps (the Davy) are used everywhere.

Stoppings, doors, and brattices are the means by which the air is kept in the right channels through a working district; and the employment of doors in particular is frequent, because there is no longer that constant coincidence, which extends so far from the downcast shaft, of the main channel for air, and the main road for coal. Several parts of the roadway are of necessity thrown out of the main current of air (technically laid dead) and prevented from giving it passage by doors, which are opened for the transit of tubs, and then closed again. These doors are made to swing and fall back to their place, sometimes by means of a weight and string, sometimes by the mode of hanging the door, and sometimes they are attended by boys.

There is a natural tendency in the development of mining arrangements to substitute mechanical inventions for those portions of the labor which have a purely mechanical character, and this tendency is often quickened by the increased economy which it allows. Hence the prevalence of self-shutting swing doors, instead of doors opened and shut by boys—a change by no means so acceptable to the men as to the masters. In the modern plans of a working district further simplification of the system is desired, by which on the whole fewer doors shall be required, this duty being performed by a suitable regulation and arrangement of the air channels.

The following method of working whole and pillar in one district, now in use at Wingate Grange, has been communicated to me by Mr. W. Armstrong, jr. The intake air-course, which

is also the horse-road, is flanked by return drifts on each side; these again are guarded by a barrier of pillars double the usual dimension, followed by a line of stow-bords. Thus the district is rendered double, its two sides receiving air from the same intake. The current first sweeps the bords, and afterwards, by several channels, reaches the juds or working places in the pillars, and presses on the goaf; it then flows back by the flanking drifts already mentioned to a main return channel. The relative supply of air to each side of the district is regulated at pleasure, by slides placed on each flanking where the air is leaving the district. The only doors necessary are on the lines of the horse-roads, between the intake air and return air; of these, the one next to the intake is a framed door, the other a swing-door. One side of the district is kept a pillar in advance of the other; as the working faces move on, the frame door is replaced by a solid stopping.

Mr. Wood has made me acquainted with an elegant method of pannel arrangement, including in one district, at one time, working in the whole, and in the broken, both being ventilated by the same air current. This method is in operation at Hetton, and appears to succeed perfectly.

In the plan which illustrates the Hetton system of cotemporaneous whole and broken pillar working, the main intake air-course, which is also the main road, is called the second north branch. It leaves the engine plane by a curve, and then goes, flanked by two parallel drifts, northward direct to the face of the working in whole coal. Two crossings are observed of air returning over this intake. Beyond (or in bye) the second crossing, the air takes a double course forward to the face; then turns in one stream westward, to sweep all the working places, being borne up to them by stoppings in a line parallel to its general course. These stoppings are in alternate rows of stone and wood; the latter, being merely temporary brattices, are removed after stone stoppings, one pillar in advance, are put in. This removal of the brattices leaves two headways courses free for the air to return eastward behind the forward row of stoppings; while the headways courses farther south permit the air to flow back again westward, and reach the juds or working places in the pillars. From them the air passes through the goaf to the opening at the top, where a regulator is placed, if the fallen material be open enough to yield it a passage. If it be too compressed for all the air to pass, the remainder is allowed to escape by opening the regulator at the bottom of the pannel, and so enter the return. The goaf thus produced is in limited tracts, bordered by barrier walls between it and the permanent air courses and roads; 10,000 feet of air per minute are given to this district of twelve bords, three pillars, and thirty-four men, in which whole working, pillar working, and goaf are

ventilated. It will be observed that, by this plan, there must always be two rows of stone stoppings, and three pillars between the whole and the pillar working; and what is not less important, there is between them a double stream of air, which is, in effect, an atmospheric wall, preventing any dangerous leakage from the currents which pass by lamps to those where candles are trusted. Lamps are used in the pillar working; candles in the whole working.

To complete this view of a subject of great importance, I am enabled to append a third plan of combined whole and pillar working, viz., that practised at Thornley Colliery by Mr. R. Heckells. In this case the intake air passes by the middle one of three parallel drifts, the flanking drifts bringing back the return air. These drifts send off a branch of exploring drifts to the east, on the same system as the main channels; which then proceed between barriers of coal, two pillars wide, holed at twice the usual interval. The air is split at the top of the intake (horse road) right and left, and so carried to the pair of working districts, the faces of which it sweeps on its return to the flanking drifts first mentioned. In working a pair of districts, one is kept a little ahead of the other. The drawing shows the way in which the pillars are attacked, and their portions successively removed. The winning headways conveying and returning the air are kept in advance of the working places.

When goaf is said to be ventilated, it is not meant that clear passages are kept up through it along which the air is impelled in certain directions, as it is through the waste,—that is to say, parts of the mine which have been opened and worked in the whole, but not in the pillars, which are left standing for some future time, and in this sense form a part of the waste. The goaf can only be ventilated by pressing air upon it on one side and receiving that air in drifts leading from it on the other side. This can only be in any degree effectual while the goaf is open, or so loosely compacted as to allow the air an easy passage. It is in the early stages of falling roof that this happens; with the progress of time the growing area of goaf opposes more and more resistance to the currents, and approaches more and more to the condition of unventilated goaf.

Fresh goaf can hardly ever be said to be entirely unventilated, because of the circumstance well known in collieries and of the highest importance in ventilating them, that where more channels than one exist between point and point, air will ever tend to divide itself and follow both channels, with such velocities in them that the sum of the resistances on its path shall be the least possible. Hence air must always tend to penetrate more or less into and to draw more or less out of goaf.

Where the goaf is margined by air-courses which offer an unrestricted path, the current sweeps the margins only, and no

ventilation-power is consumed by the goaf; but to press and compel currents through the goaf by means of regulating contractions on the more open and obvious return channels, requires a command of air. The necessity of thus ventilating the goaf must depend on the nature of the strata, the proximity of seams above and below, the system of working, and other circumstances characteristic of individual mines. At Haswell the goafs are systematically ventilated, and are, in fact, for this purpose expressly made parts of the general return air-courses, by regulating slides.

The contracted channels in goaf, situated between the advancing and returning air, are like the capillaries of the animal body; and in this analogy the return air-courses are comparable to veins, as the intake drifts represent arteries. After leaving the goaf the air is found to be impure, loaded, foul, or explosive, according to the permanent character of the locality and temporary or accidental conditions. It is a mark of good management when as much care is taken to conduct the contaminated air to the furnace (the heart of the system) as to bring in the pure air from the downcast shaft. There ought, indeed, to be more free and ample channels for the return air, because, on the average of the year, it has become warmer and expanded in volume by passing through the mine. Speaking generally, the northern district is, in this respect, deserving of praise; and it is certain that, in particular cases, there is room for farther improvement,—for diminishing velocity by increasing the sectional area, for increasing the flow of air by diminishing friction. About the point of separation between the intake and return air there must for the most part be impediments, even when goaf is not ventilated, because the different splits or distinct currents require regulation, and this can seldom be performed except by checking the too easy flow of air in some one or more channels, which specially allure it. It is well, however, to remember that by increasing the facility of return from one district its current may sometimes be augmented as much as by increasing the impediment in another district.

In its path to the upcast shaft the air is made to course in several channels, as up two, three, or four, and then down two, three, or four (technically is coursed two and two, three and three, or four and four), through the waste by passages kept open between the pillars; the several streams run by degrees together, flow with stronger currents in fewer channels, and at last rush to the upcast shaft with a force as great as that experienced when the full air entered the mine at the base of the downcast shaft. As before observed, the different collieries offer many variations in the arrangement of the returns where they enter the upcast shaft. In a majority of cases all the air passes through and over the furnace, to which, therefore, the drifts

should be spacious and immediately connected with two or more feeders. In Haswell Colliery all the air, 100,000 cubic feet per minute, passes by the furnace. In Hetton Colliery, out of 190,000 cubic feet in a minute, all but some portion which circulates in the Main coal seam (not at work) is carried over the furnace. In Wallsend three drifts, having an aggregate sectional area of 125 square feet, conduct 47,110 cubic feet of air per minute to the furnaces; the remainder, 64,250 cubic feet per minute, passing by pipe drifts above the furnace, or entering the shaft below. At Monk Wearmouth are four returns, having an aggregate section of 161 feet; two of these enter the shaft above the furnaces. The returns at Haswell are three, with an aggregate section of 141·36 feet, delivering 84,305 cubic feet in a minute. At Murton and South Hetton each of three furnaces has two main returns to it, whose section averages 45 to 50 square feet = 270 to 300 feet aggregate area, delivering 132,895 cubic feet of air per minute. In Felling Colliery there are eight bords at the short distance of 100 feet from the furnaces, up which the air returns, the total sectional area being 168 feet, and the delivery 64,650 cubic feet per minute. In Seaton Delaval one return drift, of 80 feet area, conducts the re-united air stream 82,320 feet to the furnace.

As the returns approach to their termination they become, in collieries which have only one shaft, or two which are very near each other, more or less approximate to, and may appear almost complicated with the intake air-courses, over which they are frequently carried by crossings. In such cases the outgoing and incoming currents may be separated by only one row of solid stoppings or by double doors called separation doors. If the pressure of the incoming air on these doors be tried by opening one of them and putting a water-gauge to a hole in the other, it will be found to raise a column of water $\frac{1}{10}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch, or 2 inches, according to the degree of rarefaction in the upcast shaft, multiplied by its depth. Such doors leak more or less; even solid stoppings can hardly be affirmed to retain perfect tightness, unless frequently examined, and thus it happens that air cannot be entirely prevented from escaping under the strong pressure to which it is subject from the intake to the return.

This tendency to escape is strongest where the earliest part of the intake adjoins the latest part of the return; but it prevails to some extent all over the mine. In case of accident, it is generally found that ordinary stoppings yield, and doors are blown away; wherever this happens, the current is arrested at all points beyond (in bye) the communication thus forced, and those parts of the workings are laid dead and subject to be filled and to remain so with choke-damp, the immediate and fatal follower of explosion.

The quality of the air as it returns to the upcast shaft has

always been the criterion by which to judge of the sufficiency of ventilation and the safety of the mine. The evidence of Mr. Buddle, given to Parliament in 1835, does not more fully establish the value of daily trials of the return air than the constant practice of the best collieries at the present day. I have generally made or requested this trial to be made in the most suspicious parts of the returns in the collieries which I visited, and it has been almost with surprise that I have generally found none or the very slightest indications of fire-damp on the flame. Excepting such cases as those at Wallsend, where the pillar air and goaf air are carefully carried away from the furnace, it is commonly rather difficult to find much fire-damp except at particular points known to the wastemen, where slender streams ooze out slowly from the higher ends of the goaves. Such is the effect of strong and constant ventilation.

Some difference in this respect happens from changes of weather, but in many cases the wastemen report "nothing foul," "flame as clear as in a kitchen;" and it is certainly true, as an ordinary fact, where large bodies of air pass through the mine, that the gas which was seen to flame on the face of the drifts is diluted far below explosion, and often below distinct recognition, in the returns which convey it to the upcast shaft. Even a violent outburst of gas, say of 3,000 feet, if it escaped inflammation at its origin, would probably be so mixed with air, in its winding course to the furnace, as to be no longer dangerous. The difference in specific gravity between fire-damp and common air, which causes them to separate in tranquil receptacles, is powerless to prevent mixture when both are urged swiftly along tortuous passages, coursed and dashed in divided and reunited streams along the bords and headways before reaching the main returns.

We have now reached the furnace, the heart of the circulating system of the mine, whose force is continually kept up by fresh supplies of small coal, splint, or other coal of little or no value. This coal is often got by the furnace-man, and thus the cost of the fire is little more than the men's wages, added to the interest on capital. The men employed in the work of the furnace suffer somewhat from the glare of the fire, and it is worthy of consideration and trial what remedy screens of mica, colored glass, or other material, might yield.

The construction of the furnaces varies much, and there is undoubtedly some importance attached to the right determination of their forms and proportions. The greater number of furnaces are single; several are double or twin-furnaces (as South Hetton and Wingate Grange). Some are short in the direction of the flue, others (as Murton) long: some are low in the arch over the fire (as Tyne Main): others high (as Murton). In general the drift from the furnace to the upcast shaft slopes up

ward, and is frequently of an area equal or nearly equal to that of the shaft. The length of this drift is according to circumstances. It is a rare thing to have more than one drift from the fire to the shaft; yet this occurs at Wingate Grange, where there are three such drifts, all ascending and descending in their course across a slip dike.

There is generally a travelling way round the furnace, and there are frequently small flues or draught-holes in the brickwork, along the side of the main flue, to moderate its heat; these small flues take up much air to the shaft.

The upcast shaft is either an entire clear open channel, wholly devoted to ventilation; or an entire working shaft, in which either the guide frames are placed for the ascending and descending tubs, or the pumping apparatus is fixed; or a portion of a shaft bratticed off from the remainder and similarly employed. The sectional area of the upward air passage thus afforded varies from about 30 feet to about 200 feet. The currents nowhere exceed in velocity 30 feet in a second. The highest temperature in the shaft, where the furnace-drift enters, is not very well known, except by a few trials, which seem to indicate about 400° as a maximum.*

The effect of this current of hot air, charged as it is with sulphurous acid gas, carbonic acid gas, ammoniacal vapor, steam, &c., is very wasteful, not to say pernicious, on the machinery for pumping water and drawing coal; and in shafts which are sheathed by iron-tubbing, the destruction of the iron-work (sometimes converted to a sort of plumbago) is a further source of loss. These inconveniences are so great that it is doubtful whether the enormous cost of shafts, in the Newcastle district, ought in all instances to prevent even now the construction of new upcast shafts, for air only, instead of those so generally in use for drawing coal. Some method of preventing this injurious action of the foul air on the fixed iron-work of shafts, whether by painting the iron, or by making it part of a galvanic arrangement, is very desirable, and seems not to be impracticable. The use of exposed iron tubbing in the air-shafts is unfavorable in two respects: the iron wastes, and this is expensive; it conducts heat rapidly away, and this diminishes the heat of the shaft and weakens its ventilating power. At Haswell the iron tubbing of the upcast shaft has been lined with fire-brick. A singular result has followed this change. The shaft is contracted, and might on that account have been thought likely to deliver less air, but in fact it delivers much more—a circumstance in some degree (perhaps principally, as my informant,

* Temperature at mouth of furnace drift at Willington tried up to 360° by Mr. Johnson. Temperature of furnace drift, 4 yards from furnace at Castle Eden, 192°, Mr. M. W. Robson.

Mr. John Taylor, thinks), due to the higher temperature it now acquires by the same furnace action. The air channels are something longer than they were, a disadvantage which is, nevertheless, overcome by the new conditions.

When the upcast shafts are used for air only, they may often with some advantage be capped by a chimney. This not only lengthens the column of heated air, but may sometimes be useful in carrying it away from the machinery, and preventing it from being again drawn into the downcast shaft when that is very near.

How very disadvantageous a bratticed-shaft is and must be for ventilation purposes is obvious on the least reflection. The proximity of the air channels, the difficulty of preventing intercommunication, the mutual exchange of temperature between them, the danger of much heat setting the woodwork on fire (water being sometimes applied to prevent this), the probability of the brattice being injured in ordinary working, and of being blown out in case of explosion, are sufficient objections. In the latter case the effects must be fearful, for thus the whole pit may indeed be "laid dead," with but a poor chance of escape for any of the men in it.

ART. VII.—THE METALLIC WEALTH OF THE UNITED STATES.*

THE influence of the American continent upon mankind, its discovery, occupation, and developments, cannot be truly estimated without due consideration of the mineral wealth which it has yielded. The industry and enterprise of man has always been in proportion to the supply or scarcity of the precious metals in his possession. However painful it may be to endure the cravings of any of Nature's wants when unsatisfied, even this distress is not such a powerful incentive to effort, as that awakened by the extensive field open for the hopes of gain, in consequence of the changes effected in the condition of man, through the aid rendered by the precious metals. When the American continent was discovered, the supply of these from all sources in the Old World was scarcely sufficient to maintain society, even as it then was. The riches of the mines of the New World imparted a new life to the Old World. The fruit of that impulse has been to develop a higher degree of comfort and prosperity through human society than were ever known before. But the annual supply, after the momentum was given,

* The Metallic Wealth of the United States described and compared with that of other countries. By J. D. Whitney. 8vo. pp. 510. Philadelphia: Lippincott, Grambo & Co.

has not been in proportion to the increase of mankind, or to the demands of a healthy, vigorous, onward career of human industry. All sorts of expedients have been resorted to, in order to make up the deficiency; and paper money, notes, bonds, &c., in every variety of form, have been thrust forward, like installing the shadow in the place of the substance. Rich fields of the precious metals have again been opened, and another wave of prosperity has rolled over the face of the world, adding to the comfort, improving the well-being, and stimulating the industry of a large portion of mankind.

What we have thus, in a few words, endeavored to express, comprises the permanent results which have always followed new and extensive discoveries of the precious metal. They are the only abiding features stamped upon the face of society. It is a trite remark that "Commerce is king;" but it is not a true remark. Commerce is the great civilizer, and in its footsteps follows all that is excellent or divine which mankind possesses. Yet commerce is impracticable without the precious metals.

We present this aspect of an important subject, because it is no less true than new to some who may read our pages. Upon such we wish to impress the importance, in a national point of view, of the pursuit with which we are connected, and to show in this instance, as it has often been shown before, that men of science who are engaged in exploring for mineral treasures, and those who follow in their footsteps with pick and drill, are truly benefactors of mankind. The legitimate development of the mineral treasures of a country, especially its metallic wealth, has always been systematically undertaken as soon as the inhabitants obtained sufficient capital and leisure from the other more immediate and necessary pursuits of life, and always with substantial success. As an illustration, suppose that agriculture and manufactures were sufficiently advanced in California to enable her even to export their products; add to this her golden income, and she is the most perfect commercial example of a rich State. None other could compare with her in the world: she would be the foremost in the commercial aspect of the case. Such a spectacle will yet electrify the torpid inhabitants on the eastern shores of the Old World.

It may be permitted to us, sometimes, to enter upon a commercial view where there is so much that is scientific; and for this purpose we have taken to our aid a very complete and recent work upon the capabilities of our country in the production of Metallic Wealth, by Prof. J. D. Whitney; not because the work is peculiarly of a commercial nature—on the contrary, it is largely scientific; but because it is of sufficient importance to be noticed in both respects, the latter of which, for the sake of commendable brevity, we shall do at another time.

We are gratified at the appearance of this volume, compre-

hending, as it does, so extensive a description of our metallic wealth, or a detailed account of the resources of this country in the metals and their ores, and of the present state of the development of our mining interests as compared with those of other countries. It is due to the author himself to present his own statement of the preparation of the work, and the plan pursued in it:—

"The first chapter is devoted to an explanation of the laws which characterize the deposits of the metals and their ores, and a brief description of the general methods followed in mining operations. This seemed necessary in order that the technical terms used in the course of the work might not be unintelligible to the general reader, and especially that some clear ideas might be impressed, at the outset, as to the various modes of occurrence of the useful ores, and the importance, in all mining operations of carefully recognizing these distinctions in their practicable bearing.

"In the succeeding chapters each metal is taken up, and treated, usually in separate sections, under the following heads: its mineralogical and geological occurrence; the distribution of its ores in foregin countries: the distribution of its ores in the United States. Under the first head, it is not attempted to give a full mineralogical description of all the existing ores; for this information recourse may be had to J. B. Dana's standard treatise on Mineralogy. The principal ores have been noticed, and such information of economical importance given as seemed required in order to throw light on the succeeding sections. Under the head of the geological occurrence the formations in which the ores of the metal treated of are chiefly found are enumerated, and the most important laws of the veins in their connection with the rocks in which they occur are stated.

"In the second section of the chapter, a concise description is given of the principal foreign districts where the metal under consideration is obtained, and occasionally a more minute account of mines which have an unusual importance from the amount of their produce, or the peculiar circumstances under which they are worked.

"Finally, the mines within the limits of our own country are taken up, and described as completely as the materials which could be collected by personal examinations, and from official or reliable published accounts, would allow, or as was deemed essential to the plan of the work. Having no personal interest in any mining enterprise, beyond that of a sincere wisher that this branch of our national industry may be most speedily and effectually developed with the smallest waste of money, I have not hesitated to give my opinions in regard to the value of some of our metalliferous deposits, in the hope that when favorable, they might lead to renewed vigor in their working, and

that when unfavorable, they might be of some avail in preventing useless expenditures. Whether my judgments will prove in most cases founded in truth (that they should be so in all could not be expected), time only can show. Of the imperfections and omissions inseparable from the first execution of a work somewhat new in its plan and object, no one can be more sensible than the author."

This is the first systematic and extensive view of the mines of our principal metals which has appeared. In a large number of instances, the sections of the mines are presented either as wood-cuts or lithographs. This is particularly the case with the Lake Superior mines, all the most important of which are thus represented. In these pages, the reader who desires to know the grounds upon which to form an estimate of the value of many deposits of ore, or, in other words, to know the commercial considerations by which to judge of many localities, will find a satisfactory answer. These considerations are often of more consequence to the success or failure of an enterprise, than the facility of working a mine. The commercial aspects of every case are as important as the scientific, and he who can advise upon the one, but is deficient in experience and intelligence on the other, is not a safe counsellor.

The extent of the gold-bearing belt of the Atlantic States is thus briefly described:—

"The Appalachian chain takes its origin in Canada, south-east of the St. Lawrence, and forms a broad belt of mountain ridges, extending in a south-westerly direction to Alabama. The entire length of the chain is about 1300 miles; its breadth is variable, gradually expanding towards its centre, and contracting at each extremity. The most striking feature of this mountain system is the fact that it is made up of a series of parallel ridges, very numerous, especially in Pennsylvania and Virginia, no one of which can be considered as being the main or central chain to which the others are subordinate, but the whole forming a system of flexures which gradually open out from the south-east to the north-west, as has been made evident from the results of the geological surveys of Pennsylvania and Virginia, under the direction of Professors H. D. and W. B. Rogers. Along the south-eastern edge of this great Appalachian system is a relatively narrow, undulating range, known under different names in the different States. In Vermont it is called the Green Mountains; in New-York, the Highlands; in Pennsylvania, the South Mountains; in Virginia, the Blue Ridge; in North Carolina, the Smoky Mountains. The rocks of this belt, which has a width of ten or fifteen miles, are of the lower palæozoic age, but highly metamorphosed, and, for the most part, having their organic remains entirely obliterated. Still farther to the south-east lies the great auriferous belt, nearly parallel

with the Blue Ridge, and not easily separated from it in geological age, either lithologically or by palæontological characters. The central axis of this belt has a direction in Virginia of about north 32° east; towards the north it assumes a more nearly north and south direction, and to the south it approaches an east and west line. Its width, where most developed, does not exceed seventy miles. This is about its extent on the borders of North and South Carolina. In Virginia it does not exceed fifteen miles. Starting from Georgia, and proceeding northward we find it developed in the following counties: in Georgia, in Carroll, Cobb, Cherokee, Lumpkin, and Habersham counties; in South Carolina, through the whole north-western corner of the State, especially in the following districts: Abbeville, Pickens, Spartanburg, Union, York, Lancaster; in North Carolina, in Mecklenburg, Rutherford, Cabarrus, Rowan, Davidson, Guildford, and Rockingham; thence through Virginia, in Pittsylvania, Campbell, Buckingham, Fluvanna, Louisa, Spottsylvania, Orange, Culpeper, Fauquier; in Maryland, Montgomery county. Beyond Maryland, to the north, the indications become fainter, and consist only in a few scattered lumps or fine scales occasionally picked up, until we reach Canada, where there is a considerable extent proved to be auriferous."

Of the existence of silver, copper, lead and iron, there is the following among other and more extensive remarks:—

"The silver of commerce is drawn from three sources, each one of which requires to be separately considered. One of these, the native alloy of gold and silver, native gold, has already been sufficiently illustrated in the preceding chapter—it is of quite subordinate importance, in comparison with the entire quantity furnished by the world. But, in a region where the yield of gold is very large, the silver combined with it may amount to a considerable sum in value. In the United States, it is almost the only source from which the supply of this metal which we furnish is drawn; and without a silver mine within our territory, we produce as much of this metal as Sweden, Norway, and France together, from their mines, some of which are of classic celebrity."

Copper.—"Next to gold and iron, copper is the most important metal to the United States; since, although the value of the lead raised in this country may exceed that of the copper at present, yet the large amount of capital invested in mining for the latter metal, the certainty of its increasing production, the extent and number of the mines from which it is obtained, and the fact that general attention has been called to its occurrence, within a few years, by the discovery of a new and interesting cupriferous region in this country, all combine to give to this metal a predominating interest. Of copper only can it thus

far be said, in speaking of the United States, that there are large, productive, and permanent mines."

Lead.—"In the lead-bearing veins of the metamorphic palæozoic group are included a great number of plumbiferous veins, occurring in the belt of metamorphic rocks which extends through the Atlantic States, along the south-eastern flank of the Appalachian chain. They are especially numerous in the New England States, where they have been repeatedly the object of mining enterprises, and unfortunately have thus far rarely been profitably worked or thoroughly developed. They appear, in almost all cases, to belong to the segregated class of veins, although often developed on a large scale, forming powerful and well-marked lodes. The reasons why they have failed to make profitable mines seem to be, first, because the valuable ores which they contain are too much mixed with other metalliferous substances of no value, from which they must be separated by expensive machinery, requiring skill in its construction and management; second, because the ores are not sufficiently concentrated in the veins, the rich bunches being too much scattered through a mass of barren veinstone; and lastly, though in a less degree, because capital and patience have been wanting for the development of the mines.

"I propose to commence with the New England States, and to notice most of the prominent mines of lead and argentiferous galena which have been wrought at different times, in the hope of throwing some light on the prospects of this branch of mining in the United States; trusting that what may be said may have some influence in directing the application of capital, or at least, in some instances, of checking unnecessary and foolish expenditures upon mines which give no promise of profitable working."

Iron.—"The ores of iron are so widely distributed throughout the United States, that, even were it possible to obtain accurate information concerning them in all cases, want of space would prevent its being incorporated into this work. Besides, the mere fact of the existence of deposits of these ores, even although they may be of the greatest purity and existing in the greatest abundance, is not by any means sufficient to enable one to pronounce on their real value. In the manufacture of iron there are many other questions besides quality and quantity of the ore to be taken into consideration, such as the cost and nature of the fuel to be employed, the facilities for procuring the proper flux, and the accessibility of the locality. And besides these, there is the great question of the cost of labor, which, as connected with protection and tariffs, makes the whole subject one rather to be studied as a politico-economical than as a geological one. It is sufficient for the geologist, as such, to establish the fact, that we have unrivalled natural facilities for the manu-

facture of iron; the more or less speedy development of these immense resources depends on circumstances, the discussion of which could not properly be included in a work like the present."

Doubtless, the tables of the product of the different metals would present the most accurate view of the metallic wealth of this country, if they were regarded in connection with the number and extent of deposits, and the industry which has been devoted to their acquisition. But these are found so extensively in our pages that it is unnecessary here to repeat them. In this volume they are presented, after having been prepared with much care and great accuracy. Indeed, we know of no work which presents in so small a compass so extensive statistics of the yield of gold, silver, copper, lead, and iron, in this country.

We commend this volume to the attention of the public as presenting the most extensive survey of American mines which we possess. We have refrained from noticing the views presented relative to various mines, their geological indications, and also their past history; or the geographical distribution of our metallic wealth. These, which are in truth the most important points in a work of this kind, we shall have occasion again to refer to more at length. Meantime, we are encouraged at being able to present to the notice of the mining interest in its early stage, such a volume as a part of American mining literature, and it furnishes us with the sanguine expectation that as a country we may escape such taunts as Germany is constantly throwing at England, relative to "the poverty of her mining literature, and the repeated proofs of it which the latter gives to the world."

JOURNAL OF MINING LAWS AND ORGANIZATIONS.

MINNESOTA AND NATIONAL MINING COMPANY'S SUIT.

James M. Cooper *versus* Enoch C. Roberts.

This important cause was tried at the Circuit Court of the United States recently held at Detroit, Judge McLean, presiding. It was in effect an action in favor of the National Mining Company, represented by Mr. Cooper, *versus* the Minnesota Mining Company, represented by Mr. Roberts. It involved the title to two 80-acre lots off from the east side of section 16, township 50 north, of range 39 west.

It appeared on the trial that the great Minnesota vein and also the National vein had their course across the property of over one-fourth of a mile. Witnesses testified on the trial that the premises, as a mining property, was worth at least $200,000, to which should be added improvements made by the Minnesota Company, including their stamp buildings and stamps, saw-mill, and several dwelling-houses, estimated to have cost some $25,000.

The Minnesota Company commenced mining on the property in controversy, but afterwards removed their works east on to section 15, and are now mi-

ning near the line between sections 15 and 16. They have at all times, however, been in possession of the premises, claiming title to the same under the Hempstead Lease and under and by virtue of the Act of March 1st, 1847.

It appeared that some time in the month of January, 1851, some person applied to Commissioner Kibbee, of the State Land Office, to advertise for sale the above-named section 16 as school lands, falsely and fraudulently representing that said lands were not mineral and only valuable for timber.

They were advertised in the Lansing or State Journal and sold at the end of 38 days at $4 per acre, the minimum price for school lands. The Minnesota Company had no knowledge or notice of this proceeding, the advertisement being in dead winter, and the transmission of intelligence to and from their mine being impossible in so short a period. On the supposition that the State had a good title to the whole of said section 16, our school fund would have been robbed of the enormous amount above named for the pitiful sum of $2,560.

The case was ably argued at length by Hon. Samuel F. Vinton, and Jacob M. Howard, for plaintiff, and Hon. Truman Smith, and James V. Campbell, for defendants. It was one of the most important causes ever tried in this State, and excited much interest. The court decided and charged accordingly :—

1. That the Minnesota Company had a clear title to the two lots in controversy under the Hempstead Lease and under the Act of March 1, 1847, which act authorized lessees or their assignees to perfect their titles by purchasing in fee of the government of the United States. They held that title under the lease, and under the act was paramount to the title of the State to the lots as school lands. It was a disposition of the lands in advance of the public surveys and therefore the State was obliged to take other equivalent and contiguous lands for school purposes.

2. The Court also decided that the effect of the Act of March 1, 1847, was to separate such of the lands as should be found by tne Geological survey to contain mines from the rest of the public domain, in such a manner that they could not be claimed by the State of Michigan for school lands and that the State must take other and equivalent lands in the vicinage.

3. The Court further held that the State Land Commissioner had no right or authority under the laws of this State to sell these lands on the supposition that they were school lands, inasmuch as mines were known to exist on the same, and such lands had been reserved from sale by express act of the Legislature.

The Court remarked that it was the duty of the Land Commissioner to ascertain the condition of these lands before he proceeded to sell them—he was undoubtedly shamefully deceived—but that could confer no authority to sell.

It appears that Professor Jackson had returned the east half of this section as mineral land. Should the ruling of the Court on the points named be sustained next winter at Washington, where the case is to be taken by appeal, it would seem to dispose of the title of the National Company to the east half of the section, and should the ruling on the first point be sustained and reversed on the two last, then the Minnesota Company will hold the two 80-acre lots, more particularly the subject of controversy, and the National Company the residue of the section.

The final decision in this case will be looked for with great interest, as well from the very large amount involved, as from the important principles to be established, which will affect other pieces of property of the same kind in the Lake Superior country.

The above statement, copied from the *Lake Superior Journal*, drew out a reply from one of the stockholders of the National. We extract a few points of material importance to the National Company :—

As a matter of public information, the gentleman who furnished the report

of the trial for your paper, should have stated that his honor, Judge McLean, in charging the jury to find for the defendants, said in express terms, that he was rejoiced to know in advance, that this was but a *preliminary* trial, and that it was the intention in any event, that the case should be adjudicated before a full bench at Washington, under a bill of exceptions. He therefore felt less reluctance in sending the case to the jury with instructions. He stated, also, that he had not had time to examine carefully the laws bearing upon the case, and that he was not confident upon any one of the points decided by him, but that he would hereafter give them a careful and close investigation, and if he found himself in error, he would not hesitate, but take great pleasure in reversing his present judgment.

So far from finding any fault with the Court, the plaintiffs are entirely satisfied to confide the justice of their cause to the "sober second thought" of his honor, when his mind shall have been entirely disabused of all impressions of fraud upon the School Fund.

The main object of this communication is, to prevent the National Mining Company from suffering in public estimation, by a distorted and unfair statement of the merits of the cause; and to repudiate as a base and unfounded calumny, unsustained as it is by any semblance of proof, that a wrong has been perpetrated upon the School Fund in the purchase from the State of the lands of the National Mining Company.

All that the friends of that Company desire is that their true position shall not be misrepresented, and that they shall not be placed in an attitude even of apparent hostility towards the State, whose interests instead of being injured have been most largely and extensively promoted by the successful development of the mineral treasures of the Lake Superior district, through the enterprise and perseverance of the very men who are the principal prosecutors in this case.

FALSE REPRESENTATION OF THE VALUE OF MINING SHARES.

English Court of Common Pleas.—July 13.

Slater v. *Varnish*.—This was an action to recover a sum of money, upon the ground that the defendant had falsely and fraudulently represented to the plaintiff that the Wheal Maudlin was a valuable mine; that there were 50,000 tons of mundic at the pit's mouth, which was worth 1*l.* a ton, and that by these representations he had induced the plaintiff to purchase eighteen shares in the mine at 20*l.* a share, and there was also a second count for money received by the defendant for the use of the plaintiff.

Mr. James, in opening the case, said that the plaintiff, Mr. Slater, was the well-known butcher in Jermyn street, and also at Kensington, and he sued to recover 360*l.*, which he had paid for eighteen shares in the Wheal Maudlin, and also 13*l.* 10*s.*, which he had paid for a call upon these shares; and the ground of the action was that he had been induced to buy the shares by the grossest misrepresentation as to their value. The defendant was living at a large house at Kensington, and he held himself out to be a gentleman of considerable fortune, but his business, as far as they knew, was that of going about the metropolis accompanied by a banker's book, and on several occasions by rolls of bank notes, and finding out unwary persons and inducing them to take shares in mines. The defendant happened to be a customer of the plaintiff, and he used to be in the habit of calling at Mr. Slater's shop, and talking about his mining shares, and he got so familiar, that if Mr. Slater happened not to be down in the shop, he would run up stairs to his dressing-room, in order to see "the old gentleman." (A laugh.) Mr. Varnish said he would put him in a way of making his fortune by mines, and that he might throw away his knives and choppers for ever. (Laughter.) From these interviews in the butcher's shop in the morning, he obtained from Mr. Slater a sum of 2,810*l.* 17*s.* for mining shares. Among others there was Wheal Maudlin, in Cornwall; and in February he proposed to sell Mr. Slater a number of

these shares, when he was induced to buy eighteen at 20*l.* a share, and paid the defendant for the eighteen shares 360*l.* The defendant said the mine was a very valuable one; that there was at the pit's mouth 50,000 tons of mundic, or copper barytes, which there was an offer to purchase at 1*l.* per ton; but the truth was that the mine was worth nothing, that there was no mundic, and that there had of course been no offer to buy it. He should show that the defendant had induced two persons, named Wylie and Stimpson, also to take shares in this mine, and he had obtained a large sum of money from them. Some time afterwards it was proposed that a deputation should go to Cornwall to see this mine, and Messrs. Slater, Stimpson, Varnish, and a person named Carne, who acted as secretary, went down. Stimpson was a dealer in boiled beef, while Mr. Slater dealt in the "raw material" (laughter); and it turned out that Mr. Slater was more "green," or rather more "raw," than the gentleman who dealt in the manufactured article. (A laugh.) Stimpson inquired for the mundic, but he could find none; and then he said it was all a swindle from beginning to end, and he would have them before the Lord Mayor; and upon this threat he got returned the bill he had given, and also some money. While they were in Cornwall, Mr. Carne paid for every thing, and they had music and champagne, a carriage, and other luxuries. He should be able to show that for this very mine they had given 50*l.*, and that it was an old mine worked out, and not even worth the 50*l.* Notwithstanding this, they had issued shares, first 1,000, and afterwards as many as 6,000. It was under these circumstances that the plaintiff sought to recover 360*l.*, and 18*l.* 10*s.* for calls, upon the ground that it had been obtained from him by false and fraudulent representations.

Mr. Slater (the plaintiff) said that he had known Mr. Varnish about five years, and he first mentioned shares to him in 1851. As to the Wheal Maudlin shares, Mr. Varnish said there was a profit certain, for there were 50,000 tons of mundic at the pit's mouth, and there was an offer of 1*l.* a ton for it. He did not know what mundic was, nor anything about it. Mr. Varnish was always complimenting witness upon his industry, and witness said it would be a barbarous thing if the defendant caused him to lose the earnings which should belong to his family, for he had a large family of children. Witness bought eighteen shares in Wheal Maudlin, in February, 1852, and he had to pay 18*l.* 10*s.* for a call upon them. When they went to Cornwall they had every thing they could wish as to eating and drinking, but he believed he paid for it, for they induced him to enter into other matters. He saw some stones at the mine, which looked like stones that they mended the roads with, and they told him some were copper and some were other things, but he knew nothing about it, and he came back as ignorant as he went. He had never had a farthing dividend. When he bought the shares, Mr. Varnish said he thought he could "spare" him eighteen (a laugh), but he was to keep it quite a secret, as they were then making 30*l.* a share.

Mr. Robert Slater (the plaintiff's son) corroborated his father as to what took place when the shares were sold. Mr. Varnish had also induced him to invest some money in a mine.

Mr. Stimpson (the proprietor of Williams's Boiled Beef House, in the Old Bailey) said that he had bought a 32d share in this mine for 500*l.* Mr. Varnish told him that there were 40,000 tons of mundic at 1*l.* a ton; and a professor of chemistry had seen it, and pronounced it to be worth that sum. He said he had made 19,000*l.* by mining transactions, and he might see his bank book, but witness did not see it. Witness said he had lent his money to a gentleman, but he could get it in three months, and they took his bill for the shares. After he had been in Cornwall, and could not find the mundic, he went to the office of the mine, 28, Threadneedle street, and he said to himself, "I am sure we are all done in this mining business" (laughter); for he had found out in Cornwall that he had purchased shares in a mine that they did not even hold the lease of. He said it was a regular swindle, and he would

not pay his bill, and Mr. Varnish said, "Mind, if you do not, I will make you a bankrupt." He took proceedings, and he got his bill back, and also 300*l.* He heard that Mr. Carne had been a bankrupt in Cornwall, and that he had now left for Germany. Witness threatened to take them before the Lord Mayor.

Mr. William D. Young, a ship and insurance broker, said Mr. Varnish had called a dozen times at his house about shares. As to the Wheal Maudlin, he said they might make a fortune, for there were 50,000 tons of mundic at the pit's mouth, and that Tommy Slater had just made his fortune, and might give up sheeps' heads for ever. (Laughter.) In the omnibus one morning he took out his pocket-book, and showed 20,000*l.* worth of Exchequer Bonds. He said that the shares had been worth 10*l.*, then 20*l.*, and afterwards 30*l.* a share, and that he had got just ten left. Witness agreed to buy the ten, and he paid 100*l.*, and told them, as it was such a good thing, they might take the 200*l.* out of the first dividend. (A laugh.) It was a swindle.

Mr. William Tregay, the captain of Wheal Maudlin, said he had sold the mine to Carne, in September, 1851, for 50*l.* (A laugh.)

The Chief Justice.—Was there 50,000 tons of mundic at the pit's mouth?

Witness.—No. They thought it was a good thing as a speculation.

The Chief Justice.—Was there an ounce of mundic?

Witness would not say that there was not an ounce. (A laugh.) The mine might turn out to be a good one. It was now being worked. In January, February, and March, there were 300 to 400 tons of mundic at the pit's mouth.

Mr. Wylie had taken some shares of Carne in this mine, and Mr. Varnish told him it was as good as the Devon Consols. He took proceedings against both of them, and they did not try the case, but paid the money.

Mr. George Batters, a stockbroker, said that Carne was a share-dealer or jobber in mines, and Mr. Varnish obtained customers for him. Witness knew that no such quantity of mundic as 50,000 tons ever existed at a pit's mouth. The shares were of no marketable value on the Stock Exchange.

The Chief Justice.—They were kept as a good thing for personal friends?

Witness.—Yes, my lord. (Laughter.)

Mr. W. Green said he was in business in Garlick Hill; and he unfortunately knew the defendant, he having first met him at the office of a respectable man in the City. He met him continually, and they got into conversation. He happened to go into a luncheon-house in Finch-lane, and the defendant was there, and he said, "I want to speak to you;" and he spoke about the Wheal Maudlin shares in such flattering terms that witness was induced to buy ten at 30*l.* each. Mr. Varnish said one hundred had been sold at 10*l.*, another hundred at 20*l.*, and a third at 30*l.*, and they would soon be at 40*l.*

Mr. Serjeant Byles addressed the jury for the defendant, and he complained of the prejudice which had been excited by the manner in which the case had been laid before the jury; after which it was impossible for him to obtain a fair hearing. He was prepared with satisfactory evidence to show that the proceeds of the plaintiff's check never came, directly nor indirectly, to the hands of the defendant; but, at the same time, he had great difficulty in putting him into the box to contradict the two Mr. Slaters, and the other gentlemen. It was not true that the mine was unproductive, for it was still worked. Mr. Carne had gone away, and Mr. Varnish had had in fact nothing to do with it. He, however, as he had said, could not put his client into the box to contradict the two Mr. Slaters, and, therefore, he must submit to a verdict for the plaintiff; but he hoped that his learned friend would take the verdict only on the common count, and would agree to discharge the jury upon the special count.

The Chief Justice.—I can only do that by consent.

Mr. James.—There are other proceedings, and I cannot consent.

Mr. Serjeant Byles.—Then I must submit to a verdict for the plaintiff.

The verdict was then entered for the plaintiff for 373*l.* 10*s.*—*London Mining Journal.*

COMMERCIAL ASPECT OF THE MINING INTEREST.

NEW YORK, *August* 28, 1854.

THE dullness remarkable during the last few months in all mining stocks has terminated in actual suspension of all operations in them at the Board, and only a casual one or so in private. The great losses incurred by individuals in railroad and all speculative stocks, have destroyed the surplus means, as well as the disposition, for transactions in mineral stocks. A great number of mines have actually suspended working. Among them, we have to include the *Ulster* lead mine, the stock of which twelve months ago was so lively, and the prospects of which were considered of the best kind. It is not alone essential to have a good mining property, bought on advantageous terms, but it is equally to have an efficient working management, which seems to have been wanting to this and some other mining companies. The *Pennsylvania Zinc Company* have purchased the mines near their own, and of equal extent; yet their stock does not sell for more than before the purchase. The last sale was at 1¼. *McCulloch* gold stock, once rampant at ten and twelve dollars per share, is a drug at 1¼. Great expectations are formed from the *Aberdeen Company's* mine. There is no activity of demand for its stock, owing to the scarcity of money. We heard, however, of the sale of 800 shares on the 26th August, at fifty cents per share; though the nominal asking price is one dollar.

Among the coal stocks, *Reading* and *Cumberland* are the only active ones. The former has of late been buoyant. Both Companies are doing a large and profitable business. The *Cumberland Coal Company's* directors speak confidently of their first dividend being on the 1st January next. Their whole debt is $570,000, on bonds, at 6 per cent., and their daily receipts of coal are over 1000 tons this season.

Parker Vein Coal Company is not yet out of its difficulties. The over-issues made by the old board of directors have not been redeemed; and the case seems as hopeless as it is bad. The *Phœnix Coal Company* is without a president and board of directors. Samuel Mitchell has resigned. A few shares of the stock sold, on the 26th August, at 1¾ per share.

The most prosperous mining is yet to be found in the Tennessee and Lake Superior regions. To give the utmost effect to the development of the Tennessee mines, a *Smelting Company* has been formed at Ducktown, in Polk county. We learn that its buildings and works are nearly finished, and will be ready for commencing smelting fully on the 1st September. Trials have been made, which prove satisfactory. The *Isabella Mining Company* of Polk county, the richest of all the rich mines of that county, is erecting ovens or floors for roasting their ores; that is, burning out the sulphur, and reducing them to thirty to forty per cent. of metal. A distinguished and experienced geologist and mining engineer, Mr. Bray, of London, has spent about two months in Ducktown, exploring the copper mines of that township.

[*Continued on Page* 294.]

Fluctuations to Aug. 20th, 1854, in the different Mining Stocks sold at the New York Stock Exchange and Mining Boards, showing their Highest and Lowest Points, and the Date, with the Market Value at this date, Gain or Loss for the month, and number of Shares sold.

Name of Stock.	Shares.	Par.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value Aug 20.	From July 20. Gain.	From July 20. Loss.	Shares Sold.
Aberdeen	—	—	—	—	—	—	—	—	—	—
Algomah Copper	—	—	—	—	—	—	—	—	—	—
Alleghany Coal	—	—	—	—	—	—	—	—	—	—
American White Zinc	—	—	—	—	—	—	—	—	—	—
Brookdale Lead	—	—	—	—		—	—	—	—	—
Buckingham Gold	—	—	—	—	—	—	—	—	—	—
Breckenridge Coal	—	—	—	—	—	—	—	—	—	—
Berdan's Crusher	—	—	8¼	12	7	24	—	2	—	1,450
Caledonia Coal	—	—	—	—	—	—	—	—	—	—
Calloway	—	—	—	—	—	—	—	—	—	—
Charlotte Copper	—	—	—	—	—	—	—	—	—	—
Chatham Cobalt	—	—	—	—	—	—	—	—	—	—
Conrad Hill Gold	—	—	—	—	—	—	—	—	—	—
Copper Falls Copper	—	—	—	—	—	—	—	—	—	—
Cumberland Coal	50,000	100	83½	3	29½	19	30	—	4	50,000
Dauphin and Susquehanna Coal	—	—	—	—	—	—	—	—	—	—
Dauphin and Susquehanna 7 per cent. Bonds	—	—	—	—	—	—	—	—	—	—
Dolly Hyde Copper	—	—	—	—	—	—	—	—	—	—
Duchess Silver	—	—	—	—	—	—	—	—	—	—
Douglas Houghton Copper	—	—	—	—	—	—	—	—	—	—
Flint Steel Copper	—	—	—	—	—	—	—	—	—	—
Fulton Copper	—	5	—	—	—	—	—	—	—	—
Franklinite Scrip	—	—	—	—	—	—	—	—	—	—
Gardiner Crusher	—	—	—	—	—	—	—	—	—	—
Gardiner Gold	400,000	5	2½	28	2	1	2	—	¾	900
Georgia Gold	—	—	—	—	—	—	—	—	—	—
Gold Hill	200,000	5	3½	7	2½	12	3	—	½	4,450
Hiwassee Copper	—	—	6	25	—	—	6	—	—	200
Isabella	—	—	2¾	28	2½	27	2½	—	—	500
Isle Royale Copper	12,000	10	—	—	—	—	—	—	—	—
Lindsay Gold	—	—	—	—	—	—	—	—	—	—
McCullough Gold & Copper.	200,000	5	2½	26	1¾	10	1¾	—	¾	2,400
Manitou Copper	—	—	—	—	—	—	—	—	—	—
Manassas Copper	—	—	½	26	—	—	½	—	—	200
Mineral Mining Co.	—	—	—	—	—	—	—	—	—	—
Middletown Silver Lead	—	—	—	—	—	—	—	—	—	—
Montgomery Zinc	—	—	—	—	—	—	—	—	—	—
National Copper	—	—	—	—	—	—	—	—	—	—
Neuvitas Copper	—	—	—	—	—	—	—	—	—	—
New Creek Coal	—	—	—	—	—	—	—	—	—	—
New Jersey Zinc	96,000	12½	6½	7	4¾	31	—	—	—	8,000
North American Copper	—	—	—	—	—	—	—	—	—	—
North Carolina Copper	—	—	—	—	—	—	—	—	—	—
Ohio Land & Marble	—	—	—	—	—	—	—	—	—	—
Passaic Mining & Manuf. Co.	—	—	—	—	—	—	—	—	—	—
Pennsylvania Coal	50,000	50	105	1	99½*	19	—	2	—	700
Pennsylvania & Lehigh Zinc	100,000	10	17½	1	12¼	17	1½	—	¼	4,000
Phœnix Mining and Manufacturing Co	20,000	100	2	25	—	—	2	—	—	100
Phœnix Gold	—	—	—	—	—	—	—	—	—	—
Potomac Copper	100,000	10	2	26	—	—	2	—	—	100
Potosi Lead	200,000	5	—	—	—	—	—	—	—	—
Randolph	—	—	—	—	—	—	—	—	—	—
Ripley Copper	40,000	12½	—	—	—	—	—	—	—	—
Rockland	—	—	—	—	—	—	—	—	—	—
Rocky Bar Gold	—	—	—	—	—	—	—	—	—	—
Rutherford Gold	—	—	—	—	—	—	—	—	—	—
Toltec Copper	20,000	25	—	—	—	—	—	—	—	—
Ulster Lead	—	5	¾	29	—	—	—	—	—	500
Vandenberg Gold & Copper.	—	—	—	—	—	—	—	—	—	—
Vermont Copper	—	—	—	—	—	—	—	—	—	—
Winthrop Copper	—	—	—	—	—	—	—	—	—	—

Note.—There has been no sale of the stocks of those Companies opposite to which the above table is blank. Our reports in a former Number furnish the amount of the last sales.

* Ex dividend.

The following is an estimate made by him of the capability of the Tennessee mines for producing copper ore :—

	Tons monthly.
Tennessee Mine,	800
Cherokee do.,	300
East Tennessee Mine,	300
Hancock Company,	500
Isabella Company,	1,500
Mary's Company,	400
Callaway,	700
Polk County,	1,000
	6,000, or 72,000 per annum,

yielding twenty per cent. of metal, is equal to 1,200 tons monthly, 14,400 tons pure copper, valued at $600 per ton, ... $8,700,000
Cut, ... 1,700,000

Estimated profit, ... $7,000,000

Mr. Bray left New York by the Arabia, on the 23d August, to report to the Geological Society in London, upon the geology and mineralogy of the Polk Town district. He is connected with some of the largest mining companies in the world. One of his objects in coming here was to select tracts of mineral land for purchase, on account of an English company. We understand he has made preliminary arrangements, and has agreed, subject to the approval of his principals, to purchase the following properties in Tennessee:

The *St. Mary's* mines, *East Tennessee*, *Callaway*, and some others. The plan is to comprise the whole properties so bought under one company, to be called the *Great Consols Company* of Tennessee. The purchase money is to be partly in cash, and partly in shares of the new company.

BOSTON MINING SHARE MARKET.

Boston, *August* 21, 1854.

Since our last, there has been considerable improvement in *Mining Shares*, with an increased demand, although the amount of *sales* for a month past has been unusually limited. Stocks are more firmly held, and quotations have gradually worked up without, in many instances, any public sales having been made. There is greater confidence felt among those who hold mining shares, and more disposition than formerly to buy at the present low rates, and place them away for future results, of which there can be little doubt, if the cheering accounts received from the mines are any indication as to what we may naturally expect to realize. There has, doubtless, been some mismanagement among the Lake Superior mines, which time and experience have in a measure corrected, and now greater system is observed, which will have a tendency to help forward the work of improved management. The advices received within a month, have been of the most cheering nature, and everything looks bright and prosperous throughout the mining region. Several of the newer mines, that formerly were less known, are beginning to show marked improvement, and bid fair to become, in due time, equally prosperous as the older ones, which continue to grow better and better.

Notwithstanding the highly favorable condition of the *mines*, the market value of the respective *stocks* does not keep pace with the actual improvement. This is, in a great degree, owing to the general stagnation in all stock matters, and the naturally dull state of business at this season of the year. We note, however, a very fair improvement lately, and there are good indications that the coming fall will show a large gain in the prices of most all mining stocks now current in this market. Parties who can do so, will hold their stocks for a rise, and eventually come out at a handsome profit, while those who buy at present rates must reap a large reward. It will take *time* to accomplish these most desirable results; but *they will come*, sooner or later. There never was a period when the mines stood as well as now, and nearly

all the stocks are unreasonably low, two facts which go strongly to strengthen our view of the matter, that a purchaser at this time *must make a profit*, even if he buys merely for a temporary investment; but the longer he keeps his property, the greater will be his chances of gain. We do not, of course, mean for any one to buy just what may first offer in the market, but to make a judicious selection of about a half a dozen or more from among the different stocks which are usually bought and sold in public, and then quietly wait for the future to reveal itself.

Minnesota has advanced again, and now the stock is scarce at 176 bid. The mine is now looking finely, and improves steadily. The stock is all held for investment, and is cheap at the present rates, which are equal to about $53.50 for a company with 10,000 shares—the Minnesota having only 3,000.

Pittsburg (Cliff) has advanced, as we anticipated, and now the stock is in demand at 146, dividend on of $8 per share. Eastern shareholders can obtain their dividend of Messrs. J. W. Clark & Co., Boston. The mine is going ahead as usual, and will produce a large amount of copper during the season.

Copper Falls has advanced from 44 to 53 bid, within a short time, and there is very little stock offered, though this sudden advance may bring out some. The mine is doing exceedingly well—the bars now running 32 heads of stamps, which are not sufficient to keep the mine clear of accumulating stamp rock. The erection of some newly invented stamping and washing machinery is contemplated, which it is anticipated will largely increase the future product of copper, as increased power of improved machinery is all that is needed to make the mine treble its present yield.

North Western declined to 22 under an order to sell at best price, but now 23 is the bidding price for small lots and 25 asked. The mine is producing considerable mass copper, which is good so long as it lasts, and it may hold out for a great length of time, but we believe rich stamp work is looked upon as more *reliable* for the permanent success of a mine. The *North Western* can hardly fail to become a paying mine, however, under the present highly favorable condition of its future prospects.

Isle Royale declined 13¼, but 15 is now bid, which includes the assessment of $1 per share, due August 18th. The accounts from the mine are very good, but our impression is, that the managers are somewhat disappointed at the results of the development thus far, it being much slower than many of them had anticipated. There are good indications, however, that the mine will come out right, and make a paying one within a reasonable time.

The following assessments have been called for and some of them are already due:—

Companies.	Amt. per sh.	When payable.	Where payable.
Isle Royale, . . .	$1	Aug. 18.	Washington, D. C.
Star, ...	$1	Aug. 21.	Boston
Star, ...	$1	Sept. 20.	Boston.
Toltec, ...	$2	Sept. 1.	Boston.
N. Y. & Michigan,	25 cts.	Sept. 12.	New York.

An assessment of 25 cents per share on the *Ripley*, previously noted, is due September 25th.

The *Isle Royale* assessment is also payable to Messrs Head & Perkins in this city.

Forest is firm at 10 bid, with a scarcity of stock. The mine is steadily improving, and copper is being regularly shipped with a good dispatch. From June 1, to Aug. 1, 60 tons were shipped, and the amount will reach about 100 tons before the close of navigation. The new stamp works with 32 heads are doubtless in operation before this time, and will be a great improvement on the old ones, burnt some months since. There is everything to encourage stockholders in this Company, and by another year the results will speak for themselves.

Toltec has advanced from $4 to $6, with a slight reaction since, some stock being thrown upon the market in anticipation of the $2 per share assessment, due September 1. The mine is looking remarkably well, and the

stock is cheap at the present rate. It will do to keep for the future, and cannot fail to become a valuable property.

Phœnix is in good demand at 7¼, with none for sale less than 9. The prospects of the mine are good.

National is in demand at 20 to 25 without sales, the transactions here being generally much limited.

North American is dull at 67 asked.

Among the lower priced stocks, *Algomah* is in good demand at 1¾, and is looked upon favorably in this market. This Company is working the Toltec vein, and three shafts are in progress, to be eventually drained by an adit, which, when completed, will enable the mine to speak for itself, and show well, too.

The *Winthrop* has the Hill Vein, which renders it valuable for future development. The mine is very promising for the amount of work yet performed, and in time it will make an excellent show.

Several others of the new mines are steadily improving, and the general prospects are more flattering than ever before, but the present high prices of labor and supplies will somewhat prevent the rapid development of many of this class of mines, as the force employed is much smaller than could be worked to advantage.

BOSTON MINING SHARE LIST.

Fluctuations for July, 1864, in thirty-one different Mining Stocks, sold at the Boston Stock and Exchange Board, showing their Highest and Lowest Points, and the Date, with the Market Value at the close of the Month, Gain or Loss for the Month, and number of Shares sold in each.

Mining Stocks, Boston.	Nominal Capital.	Shares.	Par.	Paid in Aug. 31.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value July 31.	From June 30. Gain.	From June 30. Loss.	Shares sold in July.	Value Aug. 31.
Adventure, *Copper.*	$250,000	10,000	25	$11.00	—	—	—	—	2	0	0	No sale.	2
Algomah	500,000	20,000	25	1.37½	2¼	1	1¼	14	1¾	—	1	460	1¾
Bay State	500,000	20,000	25	‡2.00	—	—	—	—	‡	0	0	No sale.	‡
Bohemian	250,000	16,666	13	4.94	9	6	1¾	6	‡2	—	¼	100	1¾
Boston	500,000	20,000	25	‡2.00	—	—	—	—	0	0	0	No sale.	‡
Copper Falls	800,000	10,000	80	18.00	55¾	1	44¾	15	45	—	11	370	54
Dana	500,000	20,000	25	1.62½	1	22	1	28	1	—	¼	1,043	1
Forest	200,000	10,000	20	15.00	10¼	3	8	10	8	—	¾	135	11
Fulton	500,000	100,000	5	‡2.00	‡	7	‡	15	‡	0	0	600	‡
Glen	500,000	20,000	25	‡2.00	1	27	1	27	1	—	¼	25	‡
Isle Royale	120,000	12,000	10	10.00	16	7	15	18	13¼	—	2½	100	†15
Malone, *Sandstone.*	400,000	40,000	10	8.12½	45	7	45	7	45	—	5	100	45
Manassas, *Mining.*	1,000,000	100,000	10	‡2.00	—	—	—	—	‡	0	0	No sale.	‡
Manitou, *Copper.*	100,000	10,000	3	1.25	—	—	—	—	‡	0	0	No sale.	‡
Minnesota	300,000	3,000	100	22.00	175	10	170	28	170	—	10	5	175
National	250,000	10,000	25	3.00	26	28	26	28	25	—	5	5	25
Native	250,000	10,000	25	4.75	—	—	—	—	‡2	—	—	No sale.	2
North American	800,000	10,000	80	21.50	—	—	—	—	65	—	—	No sale.	65
Norwich	100,000	20,000	5	‡5.00	—	—	—	—	5	0	0	No sale.	5¼
North Western	300,000	9,000	33⅓	14.67	24	15	24	21	22	—	2	27	23
Phœnix	300,000	10,000	30	7.00	7¼	27	7+	13	‡7¼	¼	—	190	7¼
Pittsburg, (*Clif.*)	—	6,000	—	15.50	140	17	133	21	139	—	6	29	146
Ridge	.....	10,000	—	6.50	—	—	—	—	6¼	0	0	No sale.	6¼
Ripley	.....	500,000	40,000	12½	2.50	1¼	7	14	7	—	‡2	100	1¼
Shawmut	.....	500,000	20,000	25	3.00	—	—	—	—	—	—	No sale.	1¼
Star	.....	500,000	20,000	25	4.50	—	—	—	—	—	—	No sale.	*6
Summit	.....	500,000	40,000	12½	‡5.00	—	—	—	5	—	0	No sale.	5
Toltec	.....	500,000	20,000	25	6.00	—	—	—	6	—	—	575	6¼
Winthrop	.....	500,000	20,000	25	1.25	1¼	1	28	1	—	—	1,070	1¼
Webster	.....	200,000	40,000	5	‡2.00	—	—	—	—	—	—	No sale.	‡
W. Castleton, *State.*	.....	1,000,000	50,000	20	‡6.00	—	—	—	2	—	—	No sale.	2

† Assessment paid. ‡ These are fully paid stock, not assessable.

* Ex-dividend of one share new stock for every four shares old stock, on payment, July 25th, of 50 cents on each share.

NEW YORK METAL MARKET.

August 20th, 1854.

COPPER, INGOT.

South America	per lb.	29c
United States	"	31c
Sheathing, 16 oz. and upwards	"	29½c
Braziers'	"	35c
Old Sheathing	"	26c
New Bolts	"	35c
Wire, 10c per lb. additional to card prices brass wire per No. Tubing	"	45c
Copper ore 30 per cent. per ton		$120 to 150

Copper ores are sold per rate of yield, 30 per cent. ore is worth four to five dollars per one per cent. of yield.

Composition Sheathing	per lb.	26c

IRON.

Duty 30 per cent. ad val.

American Hammered Bars	per ton	$75a85
" Refined iron	"	85a90
English common iron	"	69a70
" Refined iron	"	80
Swedish Bars	"	90a92.50
Railroad Bars	"	77.50a80
American Sheet	per lb.	5½c
English " No 1 to 20	"	4½c
" " 21 to 24, incl.	"	5½c
" " 25 to 28	"	6½c
Russian "	"	18c
English Hoop	per cwt.	$4.75a5
Amer. "	"	4.75a5
Common Bloom	per ton	45a50
Good "	"	50a55
First q'lty "	"	55a58
Refined "	"	70a74

Galvanized, card price as follows:

No. 14	per lb.	10c
16 and 17	"	10½c
18 and 19	"	10½c
20	"	10½c
21, 22, 23, and 24	"	11½c
25	"	12½c
26	"	12½c
27 and 28	"	13½c
29	"	14½c

Net, 6 months' prices.

Scotch Pig. No. 1	per ton	$38a39
No. 1 American, No. 1 Brands	"	37a45
" 1 " No. 2 "	"	36a40

LEAD.

Spanish	per 100 lbs.	$6.50a6.56½
American	"	7 a7.12½
English	"	5.50a6.75
Bar	"	6.75
Sheet	"	7.25a7.50
Pipe	"	7.25a7.50

NAILS.

Cut 4da60d	per 100 lbs.	4¼a4½
Wrought 6da20d	"	8 a10

SPELTER.

Duty:—In Pigs, Bars, and Plates, 5; Sheets, 15 per cent. ad val.

Plates	$5½

STEEL.

Duty:—Cast, Shear, and German, in bars, 15; all others, 20 per cent. ad val.

English	per lb.	$16 a18
German Cast	"	13 a14
English Spring	"	6½a 7½
American Spring	"	5 a 5½
English Blister	"	9 a14
Common American Blister	"	4½a 5
Milan, (in bond)	"	5½a 5½
Steel Cast—American	"	9 a16½
Steel Cast—Sheffield	"	16 a18½
Hoop M N L	"	9 a14
Common English Blister	"	4 a 8
Terne Plates—Coke	14x20 at	$9.25 cash.

TIN.

Banca	$30
Straits	29
English	—
Bar	—
Plates—IC Coke, cash	8a8½
" ½ X Charcoal	10a10.25

ZINC.

Duty:—In Pigs, 5; in Sheets, 15 per cent. ad val.

In Sheets	per lb.	$8½a8½

LONDON METAL MARKET.

August 7th, 1854

COPPER.

	£	s.	d.
South American	128	0	0–130

IRON.

Pig, No. 1, in Wales	4	15	0–	5	5	0
Bars, common, ditto	8	5	0–	8	10	0
Ditto, Swedish, in London	14	10	0–15		0	0
Pig, No. 1, in Clyde	4	8	0–	4	9	0

LEAD.

English pig	22	10	0–23		0	0
Ditto sheet	23	10	0–24		0	0
Ditto white	28	10	0–29		0	0
Ditto patent shot	26	0	0–26	10	0	0
Spanish, in bond	22	0	0–23		0	0
American	none.					

FOREIGN STEEL.

Swedish, in kegs	per ton	21	0	0–		
Quicksilver	per lb.	0	2	1		

SPELTER.

Foreign	per ton	20	0	0–20	10	0

TIN.

English, blocks	119	0	0–		—	
Ditto, bars (in barrels)	120	0	0–		—	
Ditto, refined	122	0	0–		—	
Banca	114	0	0–115		0	0
Straits	107	0	0–109		0	0

TIN PLATES.*

IC Charcoal	per box.	1	14	0–1	15	0
IX Ditto	"	2	0	0–2	1	0
Canada plates	per ton.	16	0	0		

In London, 20s. less at the works.

* At the works, 1s. to 1s. 6d. per box less. In Liverpool, 6d. per box less.

JOURNAL OF GOLD MINING OPERATIONS.

The last annual report of the Director of the Mint, James R. Snowden, contains so many very valuable particulars relative to the operation of that establishment and its branches, the production of gold in the United States, etc., that, although some of the particulars may have heretofore appeared in these pages, yet, in their present official form, they cannot come amiss. With the exception of some particulars of less interest, we insert it entire:—

The total coinage of the Mint and its branches for the year 1853 was as follows: gold, $55,213,906.94; silver, $9,077,571; copper, $67,059.78; total, $64,358,537.72.

It may be interesting to state, that one million of dollars weighs, in gold, 3685⅝ pounds avoirdupois; and in silver, 54,857 pounds. If 2000 pounds be taken as the ton, it will be seen that our coinage operations during the last year reach about one hundred and two tons of gold, and two hundred and forty-nine tons of silver.

The amount of gold of domestic productions deposited at the Mint and its branches during the last year was $55,622,051, of which sum $55,118,487 was from California, and the balance from the Atlantic States, except a few deposits from Oregon of the value of $13,535. These were the first deposits from that Territory, and are characterized by having an appreciable percentage of platinum sand.

The silver parted from the gold from California amounted to the sum of $407,133; in addition to which, there was received other silver of domestic production to the value of $10,146.

At the principal Mint several deposits of Australian gold have been made during the past year, amounting to $195,000.

The entire coinage at the several mints, from the time they commenced operation, is as follows:—

Mint at Philadelphia (1793), ...	$322,228,868
Branch Mint at New Orleans (1838), . . .	50,497,665
Branch Mint at Charlotte (1838), ...	3,790,038
Branch Mint at Dahlonega (1838), . . .	5,280,728
Total at all the Mints, ...	$381,797,299

I annex to this report several tabular statements exhibiting the foregoing results somewhat in detail, and presenting some other statistics respecting the operations of the Mint.

The diminution of the standard weight of the half-dollar, and lower denominations of silver coins, authorized by the act of March 3, 1853, has been attended with good results. Under its operations, we have had a large supply of silver bullion; and the silver coinage of the new issue has reached the sum of $8,654,161, which is a larger amount than was struck during the five years preceding. Several millions of silver coins have thus been added to the currency; and if the circulation of small notes could be excluded so as to render the supply necessary, in a short time the new coin would be in general use in every part of our country. The appreciation of silver rendered the alteration necessary. The silver coins of the former standard were issued at the rate of $116\frac{4}{11}$ cents per ounce. The average price of silver, of like fineness, at London and Paris, for several months past, has been 121 cents per ounce. It is very evident, therefore, that coin issued under the former standard would be withdrawn from circulation, and we would have had no silver currency except the old and much-worn Spanish fractions of a dollar, the value of which is diminished from 10 to 12 per cent. It is proper to remark, that some misapprehension has prevailed in regard to the alteration in silver coin. The idea is erroneously entertained, by many persons, that

the fineness of the silver used in the new coin is below the former standard. The only change, however, is in the weight—the half-dollar being now fourteen and a quarter grains below the former standard weight, and the smaller coins in the same proportion.

In England, since 1816, a silver currency has been maintained by similar means. There the depreciation of silver below gold, at the prices which ruled when the standards were adjusted by law, may be stated at 11 per cent. Our depreciation below the former standard, as compared with gold, is nearly 7 per cent. The profit to the British Mint, when dollar silver is sold at five shillings per ounce in the London market (which is an average price), is 7 per cent. If we bought silver at the same rate, our profit would be not quite 8 per cent.; but as our price of silver is 121 cents per ounce of standard fineness, there is an advance of $3\frac{3}{16}$ per cent., the new coin being issued at the rate of 125 cents per ounce. The apparent profit to the government is, therefore, 4 cents per ounce; but from this must be deducted certain expenses and wastage.

As soon as the wastage of the last year is determined, a report on the subject will be presented to the Treasury Department.

A charge of the half of one per cent. on the gold coinage is authorized to be made from and after the 1st of April last. The amounts of these charges at the Mint and branches are as follows:—

At the Mint of Philadelphia, ...	$109,265.41
Branch Mint at New Orleans, ...	6,684.00
Branch Mint at Dahlonega, ...	1,816.00
Branch Mint at Charlotte, ...	1,182.00
Total at all the Mints, . . .	$118,947,41

These sums will be transferred to the treasury of the United States, pursuant to the 6th section of the act of Congress before referred to.

The coins to be issued by the branch of the Mint in California will be designated by the letter S on the reverse. It is proper to remark, that the coins of the other branches are designated as follows: New Orleans by the letter O; Dahlonega, D; Charlotte, C. The coins of the principal mint are not marked by any letter.

The disturbance of the relative values of gold and silver, and the consequent effects upon national and international currencies upon coinage, and upon pecuniary contracts, is a very large inquiry, frequently under discussion in commercial circles, in the public prints, and in halls of legislation. I barely allude to the subject, without entering upon it, further than to offer one or two practical suggestions. According to well considered estimates, the production of the gold and silver mines of the world, at the commencement of the present century—not taking into account those countries of Asia which were nearly shut out from the intercourse of nations—was in the proportion of *one* ounce of gold to *forty-six* ounces of silver. Immediately before the opening of California, it had probably changed to one ounce of gold against *seventeen* ounces of silver. An average of the productions of the years 1852 and 1853, upon the same broad scale, appears to give a result of one ounce of gold to less than *four* ounces of silver. And yet, from the first of *these* periods to the last, there has been no great divergence in the bullion market from the relative proportion of one ounce of gold to sixteen ounces of silver. Surely this striking fact ought to allay the feeling of alarm so often experienced as to the abundant production of one metal and the diminished supply of the other. There is, in fact, a happy *accommodation* in the commercial world to these varying relations. When gold was scarce, silver was the great metallic basis, and the former metal was rather used as an adjuvant, specially adapted to some of the wants of trade. But since gold has become plenty, and silver comparatively scarce, the wealthier nations of the world have taken gold as their prevailing currency, making silver only a subsidiary one, just as copper is to silver. Now, as the purpose of "making change"

does not require a very large stock of metal, in comparison with the larger purposes of money, it follows that silver is by no means as much *needed* as formerly; and here we have the very remarkable, almost enigmatical sequence, that silver is valued less *because* it is less produced. The very general adoption of small gold coins, such as our dollar, and even the half of that, if it were practicable, would still further throw silver out of use, and consequently keep down its value. Large quantities of it will always be needed for plate and for ornamental work; but even in this, the growing use of electro-plated ware, in England and in our own country, is sure to have a counteracting effect. And here it will be interesting to state, that the greatly diminished cost of *mercury*, which is an indispensable agent in the production of silver, is certain to have a large effect in increasing that production. The monopoly of mercury, by which its price was advanced one hundred per cent., and consequently the mining of silver greatly impeded, has been dispelled by the opening of the rich cinnabar mines of California, and the price has receded to the old quotation. Silver mines that have been abandoned can, from this cause, be re-opened, and a greater activity may be expected in those which have been kept constantly in operation. But while the commercial or social accommodation before spoken of, and the probable increase in the production of silver just noticed, may be relied upon to prevent any such violent irregularities as would be denoted by balancing seventeen ounces of silver at one time, and at another only four ounces, against one ounce of gold, yet there will constantly be a varying percentage of fluctuation, and this will sometimes be so great as to compel a legal modification of standards, and a consequent re-coinage at the Mint. And although our own standard of silver has so lately been changed to suit the market, there is reason to fear that the reduction of weight was not sufficient, and that another re-coinage, at no distant day, may become necessary. This, however, is a part of the use for which the National Mint is maintained, and for which it should always be in readiness.

It seems appropriate to my official position that I should take this opportunity to join in the urgent demand, from various quarters, for a simple, intelligible, and well-founded system of weights and measures. The Mint has done as much as it can (and in this step it has been followed by the Bank and Mint of England), in repudiating pennyweights and grains in the mode of weighing and keeping accounts, using only the troy ounce and its decimal fractions. The sanction of law had previously been obtained for doing away with carats and carat-grains, in the expression of fineness of gold, and of an equally cumbrous notation for the fineness of silver, substituting the simple millesimal form introduced by French assayers, and becoming general in Europe. But we are still annoyed with another standard of weight, the avoirdupois pound, with its tedious and arbitrary divisions. The establishment of a simple and uniform system, applicable to every kind of weight and measurement, is greatly to be desired.

Statement of Silver of Domestic Production deposited at the Mint of the United States and its Branches, from January 1, 1841, to December 31, 1853.

Year.	Value.
1841,	$4,800
1842,	6,455
1843,	8,640
1844,	30,847
1845,	4,769
1846,	3,066
1847,	6,407
1848,	6,191
1849,	39,112
1850,	269,258
1851,	389,471
1852,	404,494
1853,	417,279
Total,	$1,590,284

Statement of Deposits and Coinage at the Mint of the United States and its Branches, in the year 1853.

	MINTS.				
	Charlotte.	Dahlonega.	New Orleans.	Philadelphia.	Total.
DEPOSITS.—*Gold.*					
U. S. coins old standard	.....	.....	.....	$14,144	$14,144
Foreign coins	.....	.....	$121,894	121,546	243,440
U. S. bullion	$305,157	$452,290	2,006,673	52,843,787	55,607,907
Foreign bullion	.....	.....	23,687	336,155	359,842
Total of gold	$305,157	$452,290	$2,152,254	$58,315,632	$56,225,333
Silver.					
Purchases	.....	.....	$4,467,456	$7,620,167	$12,087,625
Foreign bullion deposited	.....	.....	56,516	352,196	408,712
U. S. bull. parted from gold	.....	.....	12,157	394,976	407,133
Total of silver	.....	.....	$4,536,131	$8,367,339	$12,903,470
Total of gold and silver	$305,157	$452,290	$6,688,385	$61,682,971	$69,128,803
COINAGE.—*Gold.*					
Fine bars ..... pieces	.....	.....	.....	$4,576	$4,576
Double eagles ..... "	.....	.....	$71,000	1,261,826	1,332,826
Eagles ..... "	.....	.....	51,000	201,258	252,258
Half eagles ..... "	$65,571	$69,678	.....	305,770	461,019
Quarter eagles ..... "	.....	3,178	.....	1,404,668	1,407,846
Dollars ..... "	11,515	6,588	290,000	4,076,051	4,384,149
Value of gold	$389,370	$462,918	$2,220,000	$52,191,619	$55,213,907
Silver.					
Dollars ..... pieces	.....	.....	.....	$46,110	$46,110
Half dollars ..... "	.....	.....	$1,328,000	3,532,708	4,860,708
Quarter dollars ..... "	.....	.....	1,332,000	15,254,220	16,586,220
Dimes ..... "	.....	.....	1,100,000	12,173,010	13,273,010
Half dimes ..... "	.....	.....	2,369,000	13,345,020	15,705,020
Trimes ..... "	.....	.....	.....	11,400,000	11,400,000
Value of silver	.....	.....	$1,225,000	$7,852,571	$9,077,571
Copper.					
Cents ..... pieces	.....	.....	.....	$6,641,181	$6,641,181
Half cents ..... "	.....	.....	.....	129,694	129,694
Value of copper	.....	.....	.....	$67,059.78	$67,059.78
Total coinage in pieces	$77,086	$99,439	$6,532,000	$69,775,537	$76,484,062
Total coinage in value	$389,370	$462,918	$3,445,000	$60,111,249.78	$64,358,537.78

Statement of the Amount of Gold of Domestic Production deposited at the Mint of the United States, and its Branches, to the close of 1853.

MINT OF THE UNITED STATES, PHILADELPHIA.

Periods.	Virginia.	North Carolina.	South Carolina.	Georgia.	Tennessee.
1804 to 1827	.....	$110,000	.....	.....	.....
1828 to 1837	$427,000	2,519,500	$327,500	$1,763,900	$12,400
1838 to 1847	518,294	1,303,636	152,366	566,316	16,499
1848	57,886	109,034	19,228	3,370	3,497
1849	129,382	102,698	4,300	10,525	2,739
1850	65,991	43,734	759	5,114	307
1851	69,052	49,440	12,338	2,490	126
1852	83,026	66,348	4,505	3,490	.....
1853	52,200	45,690	3,522	1,912	.....
Total	$1,403,431	$4,348,970	$524,527	$2,357,147	$35,568

Periods.	Alabama.	New Mexico.	California.	Oregon.	Various Sources.	Total.
1804 to 1827	.....	.....	.....	.....	.....	$110,000
1828 to 1837	.....	.....	.....	.....	$13,200	5,063,500
1838 to 1847	$15,493	.....	.....	.....	21,037	2,623,641
1848.....	3,070	$662	$44,177	.....	.....	241,544
1849.....	2,077	32,869	5,481,439	.....	141	5,767,092
1850.....	1,179	5,392	31,667,505	.....	326	31,790,306
1851.....	817	890	46,939,367	.....	.....	47,974,520
1852.....	254	814	49,663,623	.....	.....	49,921,490
1853.....	.....	3,632	52,732,227	$13,535	5,213	52,857,931
Total..	$54,399	$14,209	$186,528,338	$13,535	$39,920	$195,350,024

Summary Exhibit of the Entire Deposits of Domestic Gold at the Mint and Branches, to the close of 1853.

Mints.	Virginia.	North Carolina.	South Carolina.	Georgia.	Tennessee.
Philadelphia.....	$1,403,431	$4,348,970	$524,527	$2,357,047	$35,568
New Orleans	.....	741	16,217	39,681	2,719
Charlotte.....	.....	3,415,287	333,417	.....	.....
Dahlonega.....	.....	83,666	211,330	3,761,582	244,956
Total.....	$1,403,431	$7,848,664	$1,085,491	$6,158,310	$283,243

Mints.	Alabama.	New Mexico.	California.	Oregon.	Various Sources.	Total.
Philadelphia	$54,389	$44,299	$186,528,338	$13,535	$39,920	$195,350,024
New Orleans	77,282	.....	19,800,751	....	7,290	19,944,681
Charlotte...	.....	.....	58,938	.....	.....	3,807,642
Dahlonega..	59,352	.....	928,150	.....	951	5,289,987
Total..	$191,023	$44,299	$207,316,177	$13,535	$48,161	$224,392,334

Summary Exhibit of the Coinage of the Mints to the close of the year 1853.

Mints.	Commencement of Coinage.	Gold Coinage.—Value.	Silver Coinage.—Value.
Philadelphia.....	1793	$247,067,760.94	$73,647,589.90
New Orleans.....	1838	36,105,865.00	14,391,800.00
Charlotte.....	1838	3,790,038.50	.....
Dahlonega.....	1838	5,280,727.50	.....
Total.....	.....	$292,244,391.94	$88,039,389.90

Mints.	Copper Coinage.—Value.	Entire Coinage.	
		Pieces.	Value.
Philadelphia	$1,513,517.17	$454,854,315	$322,228,868.01
New Orleans.....	.....	51,077,145	50,497,665.00
Charlotte	.....	914,874	3,790,038.50
Dahlonega.....	.....	1,193,124	5,280,727.50
Total.....	$1,513,517.17	$508,039,458	$381,797,299.01

MINING DISTRICTS OF CALIFORNIA.

The great body of the gold mines now wrought in California lies at the eastern rim of the Sacramento basin, extending from the Mariposa to the Feather river, and embracing a distinct degree and a half in width, commencing about twenty miles west of the general course of the Sacramento and San Joaquin rivers and reaching high into the mountains. This tract of land, about 180 miles long from north-west to south-east, and 60 miles wide, contains, so far as is known, about four-fifths of the mining wealth of the State, and has produced at least four-fifths of the gold exported heretofore. It is one continuous field, intersected by the Merced, Tuolumne, Stanislaus, Calaveras, Mokelumne, Cosumnes, American, Bear and Yuba rivers, which run nearly west in general course and are on an average twenty miles apart.

The whole country in this district is impregnated with gold, and the miner may be almost certain of finding particles of gold in every square yard of

ground where he will take the trouble to examine closely. The gravel bars, the sand and clay banks of the rivers, and the bottoms of the ravines, furnish the greater portions of the gold, but rich diggings are frequently found on the extensive flats, on the mountain sides, in the depths of the hills, and in quarry. This whole district may be said to have been opened in 1848. The first gold was discovered in February, 1848, in the centre of this district where Colma now is; and before the end of the year miners had sought and discovered the precious metal, from the Merced to the Yuba. All the quarry mines wrought in the State at the present time are in this district, and are principally in the vicinity of Mariposa in Mariposa county, Sonoma in Tuolumne county, Amador and Campo Seco in Calaveras county, Ophir in Placer county, and Nevada and Grass Valley in Nevada county. These quartz mines are nearly in a line, about thirty miles east of the Sacramento and San Joaquin.

The gold field next in importance is in the Klamath Valley, on the Klamath, Shasta, Scott and Trinity rivers. The first mining in this district was done on the Trinity in the spring of 1849; and the next year gold was discovered on Scott river and the Shasta. A great portion of the Klamath Valley is but little known, on account of the distance from the centres of trade, the mountainous character of the country, and the hostility of the Indians. The Klamath valley will have produced probably one-tenth of the gold exported this year.

The third important mining district is that of the Upper Sacramento, including the diggings on Con creek and Pitt river on the east, and Cottonwood and Clear creeks on the west of the Sacramento, and yields about one-tenth of the entire gold produce of the State. The most productive diggings in this district are in the vicinity of Shasta City, One-horse Town, Olney's Creek, and French Gulch, and their vicinity contains the only profitable gold mines yet found on the western rim of the Sacramento basin. The diggings near Shasta City were opened in the spring of 1848; those on Cottonwood and Clear creeks in 1850.

Diggings have been discovered and opened, but found unprofitable and deserted, on Russian river, in Sonoma county; on Eel river, in Mendocino county; on San Lorenzo creek, in Santa Cruz county; at Santa Anita, in Los Angelos county, and on the beach at Gold Bluff, in Klamath county.

AUSTRALIAN GOLD FIELDS.

The advices from Australia are of interest. The Turon Golden Ridge Quartz Crushing Company have proposed to purchase one of Berdan's machines to reduce their ores. None of the new diggings opened during the present year have eclipsed the old ones at Mount Alexander and Ballarat. At Tambaroora, about 1000 diggers are at work. At Kingower a nugget of 200 ounces has been raised; and one from Ballarat, of 182 ounces, has been sold to a Sydney dealer. Great difference has been found in the value of the gold; six samples from Victoria, assayed, varied from 3*l.* 18*s.* 5*d.* to 4*l.* 4*s.* 7*d*, being a difference of 11*s.* 2*d.*; the average was 4*l.* 1*s.* per ounce, being above standard value. Mr. Hargreaves, the discoverer of gold, who has received 10,000*l.* from the Sydney Government, returned to England in the *Golden Age;* in the same vessel was Mr. Latrobe, the late governor of Victoria. Four of the passengers from Australia had with them gold worth 1,000,000*l.* sterling. From Melbourne, we learn the new diggings at Farrengower and Omeo still retain popularity; but no positive results of their productiveness have been realized, owing to want of water. The attention of the government has been drawn to the importance of granting allotments of land in the vicinity of the diggings, so that the miners may be supplied with vegetables and agricultural produce. The amount conveyed by escort to Melbourne and Geelong is weekly 40,000 ounces, valued at 160,000*l.* The following figures exhibit the quantity dispatched by escort for two periods of four months, in 1853 and

1854: 1853, to 30th April, 687,429 ounces; 1854, to 29th of April, 627,514 ounces. Shipments of gold—1853, to 30th of April, 760,645 ounces; 1854, to 29th April, 713,230 ounces. Gold, it is reported, has been discovered in the Transvaal to the north-east of the Orange sovereignty, but is inaccessible on account of the Dutch settlers.

THE GOLD MOVEMENTS OF THE WORLD.

The flux and reflux of the tides of the ocean is a subject of much general interest, and one that has lately engaged increased attention among the physical geographers and mariners. The current of the sea has thus been tolerable well studied and mapped; and a closer investigation of these phenomena, and observations of the nature of the prevalent winds, have led to great improvements in navigation, by shortening considerably the passages of merchant ships from port to port. But the laws which regulate the flow of the tides and currents of the ocean, and cause its periodical rise and fall on the coasts and in the rivers, are yet very obscure and not thoroughly understood.

There is, however, a tidal current more irregular still in its ebbing and flowing; for, although governed by certain laws of supply and demand, it is extremely difficult to follow it in its circumnavigation of the globe; and it alters its course so frequently and so rapidly that no two years' observations respecting it will be found to agree. It is influenced so materially by the fluctuations of commerce, by the healthy or adverse condition of trade, by the migration and industrial energies of population, by the increased demands at certain periods for food and luxuries, that all the facts and observations relating to it, which can be accumulated and systematized, will become eminently useful to future statists and political economists. It is only within the last four years that its currents have worn for themselves certain beaten channels, and have become more clearly defined; its visible course is thus to some extent now marked out by distinctive characters and appreciable features.

The great metallic tide, starting from the north-western coast of America, flows through the golden gates of San Francisco Bay, makes for the Isthmus of Panama, where, after a temporary obstruction, and the receipt of additional supplies to its volume, from the southern ports of America, it bifurcates into two streams, the larger making directly for the Atlantic ports of the United States—New Orleans and New York—and the smaller tide proceeding through the Caribbean Sea and the West Indian group to Great Britain. Having reached New York, a steady periodical reflux of the metallic tide carried it forward to the British Channel and the coasts of Europe. Another strong set of the stream makes for the Mediterranean, and passing across the Isthmus of Suez, ultimately disperses itself on the shores of the Indian Presidencies and the Chinese ports. The next great current of the golden tide we have to notice, proceeds by irregular channels from the leading ports of the vast continent of Australia, and doubling one or other of the two southern capes, it eventually reaches the river Thames. Here a great embankment has been raised by the wisdom and labors of the British nation to check its too rapid efflux; but the impediments offered, and the strong walls of the bank, are insufficient barriers to prevent its overflow, and from time to time considerable streams ooze out, and spread over the low countries of Europe—vivifying and improving as they proceed in their various channels. Dropping the simile, however, let us examine the figures relative to specie, coin and bullion for the last few years, and the fact we have to record may serve for useful reflection and future consideration, as to the effects, temporary and permanent, produced on the various countries of the world, in their political, social, and moral condition, by the large alternate accumulation and dispersion of the metallic deposits. Gold contributes to the advantage and happiness of mankind only in proportion as it is actively and widely circulated. It is the exchange of the precious metal for some raw material of manufacture, some article of necessity, that contributes to production.

The discovery of gold took place in California in 1847, and since that year there has been shipped, up to the close of 1853, and deposited in the United States mints, $230,000,000 worth of gold dust, or in sterling value, £44,000,000. The whole produce of the California mines in the period is estimated at $260,000,000; $40,000,000 being rather a low estimate for the amount of gold dust taken to foreign countries, used in ornaments and plate, and still uncoined, &c.

In a gold producing country, the export of gold dust and bullion is a part of its legitimate trade, and the fact of such continuous export is no proof that the balance of trade is against the country, whilst the average production of the staple is maintained. The specie in the United States Bank in January this year, was sixty millions of dollars, and there was also twenty-five millions in gold and silver in the treasury offices, and certainly more gold and silver in general circulation among the people than at any previous period. The exports of specie to foreign countries, from New York, were, as we have seen, in round numbers, £2,000,000 sterling in 1850, £8,850,000 in 1851, £5,000,000 in 1852, and £5,400,000 in 1853. The shipments from other United States ports are very inconsiderable; a little is exported occasionally from Boston and Philadelphia.

Judging from the stock of gold in England as coin and ingots—stated at about £70,000,000—it appears probable that £250,000,000 sterling would nearly represent the gold existing in Europe at the period of the discoveries in California and Australia; which, together with Russia (since 1838), now constitute the main general sources of supply. Some authorities, however, rate the coin and bullion in the world in 1850, as high as £600,000,000 gold, and of silver at £1,200,000,000. M. Leon Faucher considers France possesses silver to the value of £134,000,000 sterling, of which 120 millions consists of coin; and the gold coinage belonging to France is probably not less than thirty millions sterling. It is supposed that the gold and silver coin in the United Kingdom is from fifty to sixty millions sterling. In the seventy years ending 1847 (deducting the re-coinage from light gold) our average yearly gold coinage was rather more than two and three quarter millions sterling. The following return shows the amount coined in the principal states in the last six years:

Country.	Three years, ending 1850.	Three years, ending 1853.
Great Britain,	£6,121,790	£25,095,072
France,	7,802,000	23,911,586
Austria,	1,566,422	2,982,885
United States,	8,953,001	34,269,911
Indian Presidencies,	151,786	166,270
Prussia,	707,703	86,798
Spain,	683,131	121,707
	25,485,783	$86,605,177
		25,485,783
Total,		£112,090,960

Of this about £18,150,000 were re-coinage.

In 1853 there was coined in the three principal mints of the world—London, Paris, and the United States—£35,548,803 worth of gold, and more than £3,000,000 worth of silver. With all this enormous amount of coinage, the increase of foreign trade and the great activity of productive industry, cause a steady demand for further metallic currency; and the coinage is absorbed and distributed in a manner unparalleled in any former period of the world. The following statement from the *Bankers' Circular* shows the quantities of gold received and delivered by the Bank of England, in the bullion department, in the last four years. It does not represent the actual purchases and sales of specie by the Bank, but only the amount deposited and withdrawn on merchants' account:—

	Gold Received.	Gold Delivered.
1850,	£5,939,956	£3,735,203
1851,	13,379,674	3,486,500
1852,	18,720,866	4,722,173
1853,	15,332,098	14,057,352
Total,	£53,372,594	£26,001,228

Silver being only a legal tender for small amounts in this country, beyond the exigencies of our small coinage, there is no inducement to accumulate it here, in consequence of gold being the standard of value. Hence we find that about 20½ million pounds sterling of silver which found its way to the bank vaults in the four years ending with 1853, the whole flowed out again to India, China, and France, where it constitutes the monetary standard.

According to a statement of the exports of bullion from London last year, compiled by Messrs. Haggard & Pixley, the quantity shipped amounted to about 21½ million pounds sterling, of which 5¾ millions were in silver, and the remainder in gold. The whole of the silver—except £530,000 sent to the continent—went to India, China, and Mauritius. The shipments of gold coin last year were, in round numbers, £4,000,000 to Australia and New Zealand; £9,500,000 to the continent; £1,000,000 to the Mediterranean; £375,000 to the West Indies; £286,000 to the Brazils, and £105,000 to Africa. In the first six months of the present year, specie of the value of £2,373,014 has been shipped to the Mediterranean ports and the East, of which £1,858,347 was in silver.

In 1853, 2,545,260 ounces of gold were shipped from Victoria (nearly all of it to this country), of the aggregate value of £10,181,040, and there still remained in the local banks deposits and balances of the value of £6,816,810, and specie and bullion amounting to £4,336,000. The specie imported into Melbourne and Geelong, in 1853, is stated at £2,400,000; a much larger quantity of coin, we have however seen, was sent to Australian ports, but portions of it would not arrive till 1854. Last year, 624,947 ounces of gold, worth about £2,409,783, were exported from Sydney, 50,000 ounces remained in private hands. The city banks also held deposits and balances to the extent of £5,115,689. The discovery of the auriferous character of the soil of Australia took place in July, 1851, and from that period to the close of 1853 there has been shipped more than £27,000,000 worth of gold. Well informed colonial authorities estimate the produce of the Australian gold mines, up to the close of 1853, at £29,600,000. The whole quantity exported from Australia may be thus clearly stated:—

	Ounces.
From New South Wales,	1,625,256
From Victoria,	4,617,828
Total,	6,243,084

worth, at say £4 the ounce, £24,972,336. This is only what is officially recorded as shipped; a great quantity has also been brought home privately by passengers, and we should not be far wrong in estimating this amount at £8,000,000 more; besides which there remains to be taken into consideration the quantity remaining in hand in the various Australian settlements, and in Van Diemen's Land and New Zealand.

We find, then, that despite the large proportion of gold, no one country has been able to retain permanently any considerable hoard of the precious metals. Out of the £30,000,000 raised in our Australian colonies, and shipped to England within the last two or three years, we have a stock in the Bank of England scarcely as large as we had previous to the gold discoveries, and our monetary requirements are more stringent than ever. The United States, although parting with only £32,000,000 out of the £56,000,000 received, find the balance of coin shipping out of their hands in a continuous stream. The European States and Eastern countries seem to be profiting most by the

absorption of bullion. The void in the metallic currency of most of the continental nations is fast filling up, and depreciated paper currency has been to a great extent withdrawn. Still, like quicksilver, you can scarcely follow the movements of specie, for it travels almost as rapidly from place to place as the electric fluid.

The requirements of the great European Powers for the war now carrying on, make heavy inroads on the supplies of coin and bullion, and serve to alter materially the usual flow of the metallic tide. But these unusual circumstances must react hereafter, and throw back the metallic currency into the chief centres of manufacturing production. The Bank of France and its branches had, in 1844, £10,885,000 of bullion in its coffers, which increased to £25,890,042 in July, 1852, and has decreased from that date to £13,480,255 at the last return issued early in May this year. The Bank of England has at present little more than £14,000,000 of specie in its vaults, whilst the demand on it for discounts was never so continuously heavy. The United States Banks have little more than £12,000,000 sterling in specie, besides some £600,000 locked up in the Government treasury. Every commercial country seems, therefore, as bare of coin and bullion as before the gold discoveries; and instead of repletion, there are general complaints of scarcity.

Such are the more salient features of the vast picture presented by the oscillations of this important metallic current, which ramifies and extends its fructifying stream over the civilized world; here moving in headlong force until the magnified torrent rolls its waters over the chief food-producing and manufacturing centres of the globe; and there gushing forth in tiny rills and gentle rippling streams, scarcely appreciable, so that it becomes difficult to follow it in the cycle of its never-ending rotation.—*London Gazette.*

M'CULLOCH GOLD MINE

A letter from the Superintendent of the M'Culloch Mine, dated July 21, says:—

We continued to drive along the hanging wall until yesterday morning, when we commenced to cut through the vein at 130 feet level, and have cut 14 feet through *clean brown ore*, and no foot wall yet, and this is opposite the winze from the 90-feet level, giving us a vein standing of at least 14 feet thick from level to level, being the largest and best course of brown ore ever seen since the Flood.

QUARTZ CRUSHERS, ETC.

Mr. D. C. Ambler, of New York, has taken out a patent for an improvement in quartz crushers, and thus describes his claim:—

I claim, 1st. The combination of a revolving trough with balls located therein, said balls being attached to shafts, substantially as described, and having further imparted to them a pendulous bounding motion, substantially in the manner specified, whereby quartz or other similar substances may be stamped, crushed, and pulverized in the same machine. 2d. The combination of a revolving trough with balls revolving therein by friction; but this I claim only when these balls are attached to shafts, substantially in the manner specified, whereby quartz, etc., may be pulverized and crushed, as specified.

Mr. Daniel Poole, of Mount Carmel, Illinois, has an improvement which he thus describes:—

The nature of my invention consists in the construction of a peculiarly

grooved roller, and in the combination of a pair of said grooved rollers, with a series of cylindrical rollers, used in pairs, for the purpose of crushing gold and copper quartz, the rollers being arranged as described, and the ore fed steadily to the upper pair by means of an endless apron connected with the machine, and driven as set forth.

What I claim is, the arrangement and construction of the machine, substantially as described.

SEPARATION OF GOLD AND SILVER AT THE MINT AT VIENNA (AUSTRIA).

Translated from the *Annales des Mines.*

The separation of these two metals is made by sulphuric acid, which dissolves the silver alone; the action of the acid is repeated twice in order to obtain the gold very pure. The silver is precipitated by copper from the acid. Finally, the sulphate of copper thus formed is crystallized and sold. The auriferous silver is placed with sulphuric acid in large boilers of cast iron, closed at the top by cast-iron covers, furnished with two openings. One of these openings serves for the purpose of stirring the metal with a spatula, the other affords a passage to a tube by which the acid vapors escape. These pass into leaden chambers, placed on the lowest stage of the building. Each boiler is placed on a furnace by itself. For one operation, the charge is 616 pounds of auriferous silver, and 1,850 pounds of monohydrated sulphuric acid; it is heated to 100° cent., and maintained at this temperature during twelve hours, care being taken to agitate it frequently. It is then allowed to cool during several hours, when the acid is taken away by hand, without touching the gold settled at the bottom of the boiler. The gold is finally taken out and treated a second time with concentrated sulphuric acid, in a boiler much smaller, of cast iron, and only for two or three hours. After these two actions, the gold is considered as very pure; it is washed, dried, and melted in black-lead crucibles. The sulphuric liquors are drawn together in a large prismatic leaden boiler sustained on cast-iron plates over a furnace.

There is added a proportion of water of 2,000 gallons for 1,850 pounds of concentrated acid employed for the separation of the two metals. It is heated nearly to 100° cent., and the silver is precipitated by sheets of copper. The reaction, which is very rapid, is terminated in four hours. It is allowed to cool, and the silver collects itself together. The mixture is decanted with a syphon, conducting the liquid into several successive basins. The silver is well washed several times, dried in copper basins, and then melted in crucibles. The liquor, yet very acid, is employed in the manufacture of sulphuric acid, as also the acid vapors which pass over from the boilers.

GOLD ON THE HEAD WATERS OF THE AMAZON.

The *Limo Heraldo* contains a long account of a recent discovery of gold washings at Chachapoyas, by the first party of North Americans who went to seek for gold on the upper waters of the Amazon. According to tradition, rich mines exist in that region, and, in consequence of flattering reports, put in circulation within a year or two, a considerable number of our countrymen went, a few months ago, from California and elsewhere, in search of them. We have recently seen several newspaper allusions to the disappointments suffered by those adventurers, and the sufferings to which it was supposed they had been reduced. It is gratifying now to receive more favorable news, but it is to be hoped that no future gold hunters will be rash enough to engage in expeditions to those vast and wild regions before they have certain information to guide them.—*N. Y. Courier.*

JOURNAL OF COPPER MINING OPERATIONS.

YIELD OF LAKE SUPERIOR MINES.

Nearly accurate returns have been received from all the principal mines of Lake Superior, from the commencement, both of the amount of the shipments and the yield of metallic copper; and the following table is presented in Prof. Whitney's "Metallic Wealth, etc.," as reliable, and a near approximation to truth:—

	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	Total.
Cliff	8.88	16.79	183.38	444.85	572.38	319.04	377.89	370.25	405.	2708.46
Minnesota	—	—	—	4.	34.	66.	165.	208.50	480.19	957.69
North American	—	—	—	—	22.90	76.20	76.50	22.90	112.32	310.82
North West	—	—	—	—	15.32	87.06	130.89	120.17	102.27	455.71
Copper Falls	—	—	20.	10.	10	2.	—	5.64	40.95	88.59
North Western	—	—	—	—	—	—	—	3.85	19.72	23.57
Siskawit	—	—	—	—	14.	13.80	16.68	27.80	12.87	85.15
Phœnix	—	4.	5.	—	—	—	—	7.	1.53	17.53
Forest	—	—	—	—	—	3.	150.	4.	19.25	27.75
Adventure	—	—	—	—	—	—	557.	13.	5.35	23.92
Norwich	—	—	—	—	—	—	—	2.83	15.38	18.21
Aztec	—	—	—	—	—	—	—	3.	7.	10.
Peninsula	—	—	—	—	—	—	—	—	—	2.
National	—	—	—	—	—	—	—	—	26.13	26.13
Isle Royale	—	—	—	—	—	—	—	—	8.36	8.36
Pittsburg and Isle Royale	—	—	—	—	1.50	4.	—	—	5.54	11.04
Ridge	—	—	—	—	—	—	—	—	10.	10.
Toltec	—	—	—	—	—	—	—	—	3.41	3.41
Douglass Houghton	—	—	—	—	—	—	—	—	2.33	2.33
Fulton	—	—	—	—	—	—	—	—	.56	.56
Ohio Trap Rock	—	—	—	—	—	—	—	—	1.23	1.23
Bohemian	—	—	—	—	—	—	—	—	1.44	1.44
Portage	—	—	—	—	—	—	—	—	2.95	2.95
Derby	—	—	—	—	—	—	—	—	1.31	1.31
New York and Michigan / Ohio / Meadow	—	—	—	—	—	—	—	—	1.85	1.85
Sundries	3.	5.	5.	2.	2.	1.	3.	3.	1.	25.
	11.88	25.79	213.38	460.85	672.10	572.10	779.03	791.94	1296.94	4824.01

BOHEMIAN MINING COMPANY'S REPORT.

The Report of the officers of this Company is quite brief, and we insert it entire, together with the Report of the Superintendent of the Mines, Mr. W. E. Dickenson. The mine is located in the Ontonagon region, in township 51, range 37, section 31, east half. It is known as the Piscataqua location, but is worked by the present Company under the charter of the former Bohemian Company:—

The Directors take great pleasure in presenting to the stockholders of the Bohemian Mining Company, the following statement of the affairs of the Company. This pleasure is increased by the continued excellent appearance of the mine, and the prospect of its soon taking rank among the most successful and productive mines of the Ontonagon region.

The supplies shipped to the mines in the fall of 1852 had been so heavy that during the last year the Directors found it necessary to levy but two assessments, amounting together to one dollar per share. With the amount thus raised, they have been enabled to carry on the work until the present time—proving the mine already opened, and exploring new veins. The results have been most satisfactory. The utmost economy has been observed, vouchers have been returned with each monthly account, and, it is believed, not a dollar has been disbursed in a useless or improper manner.

The encouraging letter of the Superintendent accompanying this Report, will detail the extent of the underground work and the exact cost of the improvements.

It is confidently believed that the Toltec vein traverses the entire south-east quarter of section 26, township 51, range 37, about 1052 feet north of the south line of the section. Beyond all doubt, this is a valuable portion of the Company's property, and may be worked to great advantage, or sold for a very large amount. This quarter section is separate and distinct from those sections which the Company are engaged in developing; and this circumstance goes to establish the fact of the exceeding value of the Company's property, which includes five quarter sections, containing in all eight hundred acres of mineral land, the titles to which have been proved and recorded.

So recently as February 24th last, a new vein was discovered in the No. 2 adit cross-cut, which has proved to be exceedingly rich in barrel and stamp work. In the north vein, the work of drifting continues, and with results quite equal to our expectations. In the shaft upon the south vein we have had some fine barrel work, and from present appearances we may look for greater improvement.

The whole number of the shares of the stock of the Company is 16,666, of which 2016 belong to the Company. As soon as it is deemed desirable, the Company can place these shares in the market, and realize from the sale a sufficient amount to pay all the expenses of erecting proper machinery, in order to develop the mine more efficiently and rapidly. The 14,650 shares of stock now issued are held by ninety shareholders; and it may be interesting to observe, that of these, 9,068 shares are held in Philadelphia, while the remainder has been scattered as follows:—in New York, 1323 shares; in Boston, 3350 shares; in Washington, 261 shares; and scattered through other cities north and south are 648 shares.

On these 14,650 shares there has been paid nearly four dollars and a half per share; a very small outlay, when it is considered how great are the difficulties in the outset in clearing lands, building houses, forwarding supplies, and obtaining suitable miners.

It is believed that the main difficulties of the enterprise are now happily at an end, and it remains with the shareholders to decide with what rapidity they will push the further development of the mine to a complete and satisfactory result.

At the urgent request of a large number of the stockholders, the Directors have recently established a transfer office in Boston, and have appointed Mr. O. D. Ashley to be its agent.

The Treasurer, in May last, forwarded to the mines one thousand dollars in bank-bills, which with the cash in the hands of the Superintendent, and the present assessment (pending) due July 15th, 1854, will enable the Company to work a force of twenty men until next September.

The total expenses of the mines have been as follows:—

1850 and 1851,	$19,619.43
Less gross amount sales of merchandise,	5,656.28
Total for 1850—'51.	$13,963.15
1852,	$26,134.98
Less gross amount sales of merchandise,	8,826.41
Total for 1852,	$17,308.57
1853,	$21,672.44
Less gross amount sales of merchandise,	8,383.87
Total for 1853,	$13,288.57

1850—'51,	$13,963.15
1852,	17,308.57
1853,	13,288.57
Total expenditure for four years,	$44,560.29

The monthly expense of working a force of thirty-five men has cost the Company, say $11,313.33, including the salary of the Superintendent and the board of the miners.

There are various supplies of provisions and merchandise at the mines, of which the Treasurer has yet received no inventory; but it is thought with a few additional supplies sent up during the fall, the stock will materially aid in carrying on the work through the next winter.

The annexed balance-sheet of the books of the Company will show the amount of cash on hand.

By order of the Board of Directors,

WM. MACTIER, *Treasurer.*

LETTER FROM THE SUPERINTENDENT.

BOHEMIAN MINES, *June 30th*, 1854.

CLEMENT MARCH, Esq., *President Bohemian Mining Company.*

Dear Sir:—In reply to your letter of June 10th, asking for a report of the extent of the mining work upon this location, I beg leave to report as follows:

Mining operations were commenced in this location late in 1850, under the direction of Mr. Charles Whittelsey and Captain Henry Bawden. The first mining work was the commencement of the cross-cut, adit No. 1. This work was continued till June, 1851, without making discovery of any vein of importance.

Upon the south side of the bluff a shaft was sunk, by the same parties, fifty-nine feet ten inches. In the upper part of the shaft there was a fine large vein, rich in copper; some pieces being taken out that would weigh one hundred and fifty pounds. In the lower part of the shaft the vein was lost—supposed to have been thrown by a cross-course; I should judge that this point was well worthy of a more extended search for the vein.

Mining operations were suspended upon this location in December, 1851, and resumed with four miners in June, 1852. The working, since I have had the direction, has been confined principally to developing the north vein. This vein, at the surface, exhibits itself in three parts, and is very rich in stamp work of a high per centage. The first work upon the vein was extending a shallow drift forty feet; finding the vein well marked, a shaft was started and sunk upon the vein; in some places in the shaft found the vein full nine feet in width, and rich in all parts. As we had to hoist all the surface water, another cross-cut was determined on, and accordingly driven up. This cut the vein one hundred and fifty feet below the outcrop. We found the vein here very rich in stamp and barrel work, about four feet in width. This vein has been drifted upon one hundred and thirty feet, and found very regular and *rich* in copper. A shaft has also been sunk and a winze, and the two connected by a gallery under the adit, and the shaft and winze sunk thirty feet and fifty-five feet, respectively, under the gallery.

Throughout all the working upon this vein we have found no difficulty in following it, always having the vein present as a guide. In sinking, I believe that the vein increases in productiveness; size of vein will average about two feet, and to judge from the character where exposed, this vein may be depended upon for a large and constant yield of stamp work *of as high per centage as any vein in the country.* Owing to the mine having been very wet, I have sunk a perpendicular shaft to intersect the vein below the first level, and now expect to have the shaft completed and the whim up by the middle of July, and shall then be able to drive the work upon this vein vigorously if desired.

Accidentally last August a vein was found in the low land, and as it appeared rich, a shaft was started upon it and sunk ninety-six feet. Our most sanguine expectations were more than realized. We raised one piece that will, undoubtedly, weigh one thousand pounds; another, four hundred pounds; and another, three hundred and fifty pounds; besides about one ton in small pieces, and a large amount of stamp work; and I think we have over five tons of copper in sight in the shaft.

This channel of ground, I have been informed, resembles the Isle Royale Mine of Portage Lake, and of its extraordinary richness there can be no doubt. Owing to the scarcity of men, and the quantity of water making in the shaft, the work has been suspended at this point, and the miners put to work about eight hundred feet east to drive up a cross-cut of eighty feet to cut what we suppose to be the same vein. They are now in about sixty-five feet, and will probably reach the vein next month. This comprises the entire mining work upon *this* location to date, and the prospect is regarded as sufficiently encouraging to warrant more extensive working, and the belief that the stockholders will meet with success from the future working of the mine.

The mine is now, or soon will be, in a position to work quite a full force of men. I inclose a schedule of a force that, in my judgment, could be employed to advantage. This force could not be put at work in the due proportion of mining and surface men, as we should be obliged to build more houses, and therefore, in the outset, employ a greater proportion of surface men.

The course I should be tempted to pursue, would be to extend the first level below the adit (north vein) west, also sink the shaft down sixty-six feet, and then drive east and connect with the winze. I would extend the mine west in preference to any other course, and would do so by two levels if possible, connecting wherever necessary by winzes. I would not sink any more shafts until satisfied of the prospects of the vein. I would also drive No. 2 adit cross-cut during the winter to improve the ground.

Upon the south vein, as the work would have to be guided by the discoveries made, I can only say, I would employ such a force in sinking, driving, &c., as would be warranted by the prospects, which at present are favorable. If it should be decided to work this vein with a force of miners required to develop it rapidly, I would urge upon the Company the purchase of a small engine, ten or twelve horse power, to raise the rock and water. The outcrop of the vein, being in low land, the single shaft now down makes from eighty to one hundred and fifty barrels of water in twenty-four hours. The cost of such an engine would not exceed the expense of a whim, horses and feed. I would not advise the erection of a stamp engine this season; freight and wages are too high to warrant the doing of work that can be dispensed with, without detriment to the mine.

I remain, very respectfully, your obedient servant,

WM. E. DICKENSON, *Superintendent.*

The balance sheet, referred to above, to June 30, 1854, makes the following exhibit:—

Capital stocks,		$94,397.50
Less cost of real estate—		
Bohemian Mining Co., 5 qr. sections, 640 acres,	$14,000	
Piscat. Mining Co., 1 qr. section, 160 acres,	15,200	
		29,200.00
Credit,		$65,197.50
Bills payable,		2,500.00
Sales of copper,		1,601.20
Total credits,		$69,298.70

Dr. Insurance account,	$67.89	
Interest account,	185.76	
Superintendent's accounts,	882.69	
Sundry accounts,	2,852.87	
Mining expenses,	48,172.50	
Supplies account,	16,070.52	
Profit and Loss account,	795.90	
Cash balance on hand,	320.57	
		$69,298.70

ONTONAGON MINES.

The following particulars respecting a few of the mines in the Ontonagon region is furnished to the *Lake Superior Journal* by those to whom the reports were made :—

Minnesota.—The Minnesota vein has been fully proven by the results of the past three years, and they are now producing over 60 tons a month of 75 per cent. copper. Rockland, on the same vein, and immediately adjoining the Minnesota, was commenced about one year since, and has made considerable progress towards being a mine, producing in the time from the shaft and levels, about 70 tons mass, barrel and stamp copper. The next year will open ground to work about 80 miners, and will warrant the continuance of stamps and other machinery for a full working, and as they expect, a paying mine. The calls on the stock for assessments has been but 25 cts. per share.

Flint Steel.—The Flint Steel Mine, one mile from the Minnesota, and, as all appearances indicate, on the same vein. They have driven an adit on the course of the lode, 385 feet in length, and sunk one shaft 70 feet. The lode producing well, and from the shaft and level raised about 60 tons mass, barrel and stamp work. Buildings are completed to work about fifty men, and the work is going vigorously forward. Thus far there has been no call upon the stock for assessments, the Company appropriating 2000 shares of stock for sale to work it. It is supposed the calls on this stock will be very light until its productions support the work—unless for stamping machinery, which will be required next summer.

The mineral range between the Ontonagon and Flint Steel is being fast developed, and seems to be realizing the most sanguine expectations, and has become the most important tract in this remarkable mineral country. Its productions are not only copper, to surprise the world, but recent discoveries of considerable quantities of silver lead to the expectation that veins of silver may become as important as they are and have been for copper.

Rockland Mine.—We are pushing forward the work at this mine as vigorously as possible, and are making rapid progress in the openings, which are already of considerable extent.

No. 1 shaft is sunk to the 1st level,	72	feet.
Do. " below do.	42	"
No. 2 shaft " to 1st level,	78	"
Total depth of shafting,	192	"

We have also commenced to sink No. 3 shaft 320 feet east of No. 1.

In 1st level we have drifted west to No. 1 shaft,	153	feet.
" do. " " east to No. 2 "	102	"
" adit level, " to cut the lode in 2d level,	270	"
" 2d " " east from adit,	76	"
" do. " " west of do.	23	"
Total extent of drifts,	624	"

We have a good lode in the lower level of mass and barrel copper, about 15 inches thick. This level will be connected with No. 1 shaft in about six

weeks, giving ventilation and drainage to that depth. The upper level will be connected in about two weeks, opening 300 feet of ground in length, with 70 feet back for stoping. Both ends of the drift, going towards each other, are carrying mass copper. As soon as the adit level is connected with shaft No. 1, we shall commence driving south, to cut the main lode.

The whole work promises well; and having the advantage of three veins, all within 100 feet of each other, cannot but prove a splendid property. We shall push this work ahead, adding buildings, machinery, and men, as it progresses. At the commencement of next season, the mine will be sufficiently opened to require stamps, and large results may then be expected in the production of copper. At present, we have on hand about 10 tons of mass and barrel copper, which will be sent forward with the further production of the present season; also, about 50 tons of good stamp work on the surface.

The buildings already completed and in course of erection at the mine consist of one two-story dwelling house, to accommodate 60 men; two log cabins, to accommodate 20 men; one dwelling house for the captain; a blacksmith's shop, a barn, 1 whim house, and 2 shafts houses—in all, 9 buildings, costing about $4,000.

NORTH SHORES OF LAKE SUPERIOR AND LAKE HURON.

Bruce Mine.—This mine is located on the north shore of Lake Huron. The latest reports from it present the following particulars:—

This mine continues to improve in the quantity and quality of the ore raised, and the village-like looking place altogether is progressing finely. They have, on the location, some four hundred persons connected with the mine. The mine work is being done on two veins, about one hundred feet apart, and the ore that is coming to the surface is of the richest and most beautiful description, and promises rich returns for the great outlay of the enterprising proprietors of this concern. They have now two crushers and thirty jigging machines in operation in dressing up the ore, and are re-dressing, at a handsome profit, the old work once stamped and thrown aside.

The Company are having erected a new ore-separating and dressing machine, patented in New York, which is expected to be very advantageous to the concern. The agent of the Company, who has undertaken this business, G. A. Spraker, Esq., is now engaged on the work. The ore-dressing company, we understand, dress the ore for a certain per centum of the same, and if it succeeds as well as is now anticipated it will be of immense advantage to the Montreal Mining Company, and a handsome speculation for the proprietors of the patent.

This Company have shipped this season two hundred and fifty tons of ore, and have a contract to furnish twelve hundred tons for a Baltimore smelting establishment, and from the amount of ore now dressed, we should say they had nearly the quantity required. They own a steamboat, which carries down ore, and brings up supplies for the mine; besides which, there are two or three sail vessels running to the mine. Mr. Barron continues the Superintendent of this extensive concern.

The following observations relative to the north shore of Lake Huron, with some particulars of the Bruce and Wellington Mines, are taken from a correspondence in the *Lake Superior Journal*:—

About Copper Bay there is a fine opportunity for studying the *drift* formation. These erratics, of all sizes, from huge blocks of some hundred tons weight, down to small pebbles, sand, and loam, lie scattered promiscuously over the solid rocks in *place*, without the least reference to the undulations of these rocks, being as thickly strewn over the highest bluffs as in the lowest valleys, except on some exposed points where they appear to have been pushed off, thereby leaving the rock in *place* naked. And over the *drift* lies an allu-

vium of varied thickness according to the rising and falling of the rock beneath; in the low depressions it is deeper—on the higher levels it is shallower, but does not extend anywhere more than 25 or 30 feet above the present water level of Lake Huron; it is evidently the work of the Lake at a distant day, is laid down in thin horizontal layers with great regularity, is in some places composed of pure clay, in others of sand or clean water-worn pebbles. This alluvial (or perhaps more properly) lacustrine deposit is the newest formation I have met with anywhere in the country, above high water mark—and the isolated masses of primary limestone and old red sandstone that crop out here and there, are decidedly the oldest—the trappean rocks and drift deposits occupying an intermediate place in point of age. To the eye of the geologist, the respective ages of these rocks are just as clearly defined as their different positions.

The "Bruce Mine" is still carried on with the usual energy that has characterized all the operations of the Montreal Mining Company; and I am happy to say, is likely to yield another handsome dividend this season.

The "Wellington Mine," to the west of the Bruce, under the management of Captain Vivian, is a splendid concern; such a lode as they have there, is a sight worth seeing—the vein where they are at work is 10 feet wide, the walls beautifully defined, and filled regularly up with rich ore. But the most interesting object that I saw there, was "Bradford's ore dresser," which they are now fitting up at the "Bruce" on a large scale. This, I believe, is an American invention, and promises to be of vast importance in this part of the country, as by it they can dress the poorest ores, extracting every particle of copper from the gangue. It is not so speedy as the old Cornish system, so that when the ore is rich, the old system will be adhered to; but Bradford's machine is a regular "save all," and for the poorer samples of ore will be invaluable, as by its application thousands of tons of good copper will be saved which under the old system would be thrown away. The saving in freight too will be immense. By the old apparatus, the best ores at the "Bruce," I believe, seldom averaged more than 14 or 15 per cent., owing to the quantity of waste rock still retained with the pyrites; but by Bradford's machine the cleansing is so perfect, that the poorest samples can be dressed up to 30 per cent.

Some brief but accurate statements respecting the north shores of Lake Superior and Lake Huron, are given in Professor Whitney's recent work, together with more full particulars respecting the mines there, which we deem of interest to notice in this connection:—

Numerous companies have been formed at various times for working copper mines on the north shores of Lake Superior and Lake Huron, within the Canadian limits, but only one has as yet proved successful. The attempts at mining which have been made were in the trappean rocks, analogous in geological position to those of the southern shore, and also in the rocks of the azoic period. It is only in the latter that they have, thus far, given encouraging results.

The character of the rocks on the north shore of the Lake has not yet been thoroughly investigated; but, from a hasty survey, during the last summer, of a part of the region which lies to the north of Isle Royale, it appears to me probable that the trappean rocks which form the lofty cliffs of Pie Island, Thunder Cape, and the numerous islands in that vicinity, are the counterpart of those of the south range of Keweenaw Point. No workings are now going on here; but from 1846 to 1849 a powerful vein was worked on Spar Island and the mainland opposite, at Prince's Bay. The vein on Spar Island has a course of north 32° west, and is made up almost entirely of calc spar, heavy spar, and quartz, and is 14 feet wide at the southern edge of the island, where it forms a conspicuous object, contrasting strongly with the

dark-colored trap, and being visible from the Lake at a great distance out. It contains a little yellow sulphuret of copper and variegated ore, and two shafts have been sunk on it to the depth of 47 and 24 feet. The quantity of ore is small for working. On the mainland the same vein appears, having a more quartzose gangue, and carrying sulphuret of zinc principally, with native silver in pockets. Splendid crystallizations of amethystine quartz and calc spar have been obtained here. The vein has been opened on the mainland by sinking and driving, at a very heavy expense, as the body of the lode consists of crystallized quartz. A bunch of calc spar and blende, rich in native silver, was struck near the surface, at the collar of the deepest winze, and led to unbounded expectations on the part of the shareholders, which were unfortunately destined to be entirely disappointed.

A number of localities were formerly explored and worked to some extent on Michipicoton Island and on the north-eastern side of the Lake, but they are now all abandoned. The "Quebec and Lake Superior Mining Association" commenced operations in 1846 at Pointe aux Mines, Mica Bay, on a vein said to be two feet wide and rich in gray sulphuret of copper. An adit was driven 200 feet, three shafts sunk, and the 10-fathom level commenced. Smelting furnaces were erected, and after £30,000 had been expended, it seems to have been discovered that there was no ore to smelt, and the works were abandoned.

The mines on the north shore of Lake Huron are in a formation consisting of white, and often vitreous, sandstone or quartz rock, passing into a jasper conglomerate, and interstratified with heavy masses of trap. These are supposed by Mr. Logan, the Provincial Geologist, to be of the same age as the copper-bearing rocks of Lake Superior, and he remarks that the chief difference seems to lie in the great amount of amygdaloidal trap present in the latter formation, and of white quartz rock in the former. There can be no doubt, however, of the identity in age of the sandstones and conglomerates of Keweenaw Point with those extending along the shore of the Lake on both sides of the Point, and recognized by Mr. Logan himself at Saut Ste. Marie as of the age of the Potsdam Sandstone; and the same beds are recognized in their continuation east as being deposited unconformably on the cupriferous beds of the northern shore of Lake Huron. Hence the inference is unavoidable, that these latter are older than those of Lake Superior. This is corroborated by the fact, that in the Lake Huron mines the ores are entirely sulphurets, and principally copper pyrites, associated with a gangue of quartz, differing wholly in these respects from those of the really productive part of Lake Superior.

The Bruce Mine is the only one now working on Lake Huron, and this Company has been quite successful, and might have been much more so had proper discretion been used in its management. The vein was, from the beginning, worked with an entire want of mining skill; during the first year an open cut was made, which was 126 feet long and 5 feet deep; from this excavation 240 tons of ore were taken. Afterwards much money was thrown away in costly machinery not at all adapted to use in that region.

The mine is situated about 50 miles below Saut Ste. Marie, and due north of the extremity of St. Joseph's Island. The vein was discovered in 1846, and is contained in a dark-colored hornblende trap: the ore is chiefly copper pyrites, with some variegated ore. The deepest shaft was down, in 1853, 51 fathoms, and the vein was then 3 feet in width, and well filled with ore disseminated through quartz. Very expensive smelting works have been erected here, but have proved a great source of loss and embarrassment to the Company, as the ore can be transported almost from the mouth of the mine to Swansea, all the way by water, without transhipment.

The entire amount of ore raised at this mine I have not been able to ascertain, but it is very considerable. During the year 1853, 1650 tons were shipped, and sold mostly in New York, netting to the Company £22,086 cur-

rency. A dividend was paid of 5*s.* per share on 45,402 shares, during the past year.

This is truly a valuable mine, and should produce largely; indeed, it appears that within the past year a new order of things has commenced, and the expectations of the Company that, hereafter, 300 tons of ore per month will be shipped, seem likely to be realized.

There were several other companies located on the north side of Lake Huron, but I know of none now at work except the Bruce. The success of the latter will probably induce those claiming or owning property in the vicinity, to cause more thorough explorations to be made on their territories. The Wallace Mine, 16 miles from La Cloche, a station of the Hudson's Bay Company, is said to have furnished copper pyrites resembling that of the Bruce Vein, and also nickel and cobalt ores of considerable richness. An attempt was made to resuscitate this concern, which belongs to the Upper Canada Mining Company, in 1853, but with what success I have not heard.

CLEVELAND COPPER SMELTING WORKS.

A visit to the Copper Smelting Works of J. G. Hussey & Co., will at any time repay the intelligent visitor. We have before spoken of the importance of the business to this city, and of its rapid increase within a few years. At present the works are turning out six tons of ingots daily, worth on the spot $600 per ton. If ore enough were supplied to keep the works in constant operation, they would, without increasing their present capacity, turn out over 2000 tons of ingots per annum, worth $1,200,000. At present they are kept in operation about three-fourths of the year. It is probable that after the first of May, 1855, they will be kept in constant operation.

The cost of smelting copper is far less than some people imagine. The masses, some of them weighing over 6000 pounds, are put into the oven without breaking. Coal is used exclusively, as the oven is so constructed that only the blaze comes in contact with the metal. When the Saut Canal shall have been completed the cost of shipping the ore to this port will not be over $4 per ton. When it is considered that the ore yields about 66 per cent. of copper, it will at once be considered that Cleveland is the natural point at which it must be smelted, unless coal in great abundance is discovered in the Lake Superior region.—*Cleveland Leader.*

COPPER ORES IN WALES AND CORNWALL.

Particulars of Copper Ores sold in Cornwall, from June 30, 1853, to June 30, 1854.

Copper ores,	180,687t. 0c.	Average produce,	6¼
Fine copper,	11,779t. 14c.	Average standard,	£140 2 0
Amount of money,	£1,153,756 3s. 6d.	Average price,	6 7 6

Particulars of Copper Ores sold in Wales, from June 30, 1853, to June 30, 1854.

Copper ores,	36,156t. 0c. 0q.	Average produce,	12¼
Fine copper,	4,748t. 7c. 3q.	Average standard,	£124 6 0
Amount of money,	£508,929 17s.	Average price,	14 1 6

Totals in Cornwall and Wales.

Copper ores, ... 216,843t. | Fine copper, ... 16,528t. 1c. 3q.
Amount of money, ... £1,662,686 0s. 6d.

Copper Ores sold at the Ticketings in Cornwall, from June 30, 1835, to June 30, 1854.

Date.	Ore (21 cwts.)	Money.	Produce.	Standard.
1835,	150,617	£893,402 15 0	8¼	£106 11 0
1836,	140,981	957,752 8 6	8¼	115 12 0
1837,	140,756	908,611 15 0	7¾	119 5 0
1838,	145,089	857,779 11 0	7¾	109 3 0
1839,	139,551	912,297 12 6	7¾	110 2 0
1840,	147,366	792,7.8 3 6	7¾	108 10 0
1841,	135,000	819,949 2 0	7¾	119 6 0
1842,	135,581	822 870 12 0	7¾	120 16 0
1843,	144,8.6	804,445 19 0	7¾	110 1 0
1844,	1?2,667	815,246 9 6	7¾	109 17 0
1845,	157,000	835,350 19 6	7¾	108 10 0

Date.	Ore (21 cwts.).	Money.	Produce.	Standard.
1846,.....	158,913	886,785 1 6	7¾	106 8 0
1847,.....	148,674	810,739 9 0	8	108 12 0
1848,.....	155,616	825,080 2 6	8¼	97 7 0
1849,.....	144,983	716,917 7 0	8¼	92 11 0
1850,.....	150,890	814,087 3 0	7¾	103 19 0
1851,.....	154,299	808,244 1 6	7⅞	101 0 0
1852,.....	152,802	828,057 19 6	7¾	106 12 0
1853,.....	180,095	1,124,561 2 0	6¾	136 16 0
1854,.....	180,687	1,153,756 3 6	6¼	140 2 0

—*Gryll's Annual Mining Sheet.*

DESTRUCTION OF IRON WORK IN COPPER MINES.

Cupreous water acts on iron in virtue of the greater degree of affinity which iron has over copper for assuming the state of a salt; hence it is, that when a salt of copper comes into contact with metallic iron, metallic copper is separated, while the iron enters into combination with the acid, or other non-metallic element of the copper salt. If we, then, suppose that in a copper mine the bright surfaces of the pitwork be brought into contact with the water of the mine, as it must be in the action of pumping, and that that water holds carbonate of copper in solution, the result may be the formation of metallic copper, and the production of carbonate of iron. It, therefore, becomes imperatively necessary, that for the preservation of the pitwork of copper mines some method of separating the copper held in solution should be obtained; this is best effected by placing sheets or scraps of iron in the cisterns and at the bottom of the shafts, so placed that before the water has obtained access to the wind-bore it may have come into contact with the iron; the portions of iron should not be rusty, otherwise their object will be defeated. The sediment obtained by this means will contain from 40 to 90 per cent. of fine copper; it must be carefully collected at intervals, varying according to the quantity of water and amount of copper contained in the water, and the pieces of iron replaced by others. In mines where the ore is altogether the yellow sulphide, or copper pyrites, these precautions need not be so much attended to, as the quantity of copper held in solution will not materially affect the iron-work, nor will it pay the cost of collecting. The process will be used with the greatest success in mines where the ores are the carbonates, the black oxide, and the gray ores or sulphides of copper. During the working of the Ovoca Mines, in Ireland, nearly 16,000*l.* worth of copper was obtained by these means in the comparatively short space of seven years.—*Corresp. London Mining Journal.*

AMERICAN MINING COMPANY'S MONTHLY REPORT.

NORWICH MINE, ONTONAGON COUNTY, LAKE SUPERIOR, *Michigan, August* 5, 1854.

HON. F. E. PHELPS, *President American Mining Company:*—

This mine is situated on the west branch of the Ontonagon River, Ontonagon county, Lake Superior, Michigan, on sections 11, 12, 13, and 14, township 49 north, range 41 west, containing 320 acres of land. There also belongs to this mine, 320 acres of bottom and timber land, on section 25, in the same township. The distance from this mine to the county seat, the flourishing village of Ontonagon, where the river empties into the lake, is twenty-one miles by road and river.

The Norwich mine was organized in May, 1850, but was not worked with any considerable force till 1852. Since then, a great amount of work has been accomplished. Shaft A has been sunk 80 feet; shaft B (the main shaft), 337 feet; shaft C was sunk 23 feet from the surface, and there stopped, but was commenced again, in the upper adit, some thirty feet below the point where it was left, and extended below the adit thirty-five feet; shaft D has been sunk 70 feet. An adit (called lower adit), commencing at the base of the bluff, has been driven in 526 feet, at the end of which it intersects the

main shaft B, 270 feet below the surface. This adit is the business thoroughfare of the mine.

The ground lying between the surface and the plane of the lower adit, or adit level, is divided into three sections or working levels. The first, from surface, has a downward extent of 70 feet; the second, 60; the third, 140. On the bottom line of each of these sections, or working levels, and on the vein, a drift has been run from shaft B, preparatory to stoping; the one for the first section extends already 205 feet west; for the second, 251 west; for the third, 236 west, and 150 east. Shaft A produced "mass copper," stamp, and barrel work, throughout its whole downward extent. Shaft B (sunk on a cross-course) produced, in the first and second sections, good stamp work. In section three it produced "mass copper," as well as stamp and barrel work. In section four (below the adit level), it produced three tons of "mass copper" (including a little barrel work), besides stamp work, much richer than that of the upper sections. Shaft C has been quite barren, being on a cross-course. Shaft D produced "mass copper," and both stamp and barrel work, but in no considerable amounts; and as it is now believed to be not on the main vein, it is proposed to carry it down no farther at present.

The extent of stoping performed, in the several sections or working levels, is indicated by the shadings on the accompanying map. The product of section 1 has been thus far chiefly stamp and barrel work, with occasional bodies of "mass copper." In section 2, the average size of the vein is greater than in section 1; it also produces more "mass copper," and richer stamp and barrel work. Near the west end of the drift for section 2, important masses of copper are now exposed, extending down into section 3. In section 3, the vein is larger than in either of the upper sections, and is richer in "mass copper," and in stamp and barrel work. A large body of "mass copper" is now standing in the drift for this section, west of shaft B. At the extreme west end of the drift, a blast exposed, the first of last week, a most beautiful and promising mass of copper. No drift has yet been run preparatory to stoping in section 4. This section, therefore, can be judged of only from disclosures made on its upper line in running the drift for section 3, and in sinking shaft B sixty-seven feet below the lower adit.

This mine possesses a steam stamping-mill, with shafting fitted for running thirty-two stamps. Twelve are already in, and successfully at work. More will be put up in the course of a few weeks. For the time they have run, they have produced each at the rate of a ton per month of dressed material, averaging from sixty-five to seventy per cent. pure copper, including one-eighth cover work. By the results experienced at other mines, and by those already accomplished at this, it should seem to be well settled that each stamp, properly operated on so rich a substance as the Norwich mine affords, will produce, monthly, at least three-fourths of a ton of dressed material, averaging sixty per cent. copper, exclusive of cover work. It is the opinion of those, who, for their knowledge and candor, are fully entitled to confidence, that the mine, as now opened, is fairly capable of keeping at work sixteen stamps, which would yield twelve tons per month, or 144 tons a year, besides cover-work. The copper in each ton of this material would be worth, in Detroit, at present rates, $360, or six dollars for every one per cent., making the annual product of sixteen stamps, besides cover-work, amount to $51,840. This is not all. Judging from the present appearances of the mine, and the degree of efficiency with which it is now worked—that is to say, if the mine continues to afford "mass copper" at its present rate, and no more, and if it is worked with sufficient force to keep but sixteen stamps in operation—even in such case, it is deemed within bounds to estimate the annual product of "mass copper" and barrel work at 100 tons, averaging 80 per cent. copper, making the total annual product amount to $109,460, thus:—

144 tons of dressed stamp work, containing 60 per cent. copper, at $360,	$51,840

16 tons of cover-work (one-eighth of the quantity of stamp work), at $540,	$9,720
100 tons of "mass copper" and barrel work, averaging 80 per cent., at $480,	48,000
Total,	$109,560
The cost of getting out this amount of copper, and delivering it in Detroit, and smelting the same, estimated from the facts of past experience, as per accompanying schedule, cannot be far from	70,000
Leaving an annual net profit, under the conditions and limitations stated above, of	$39,560

But it should be remarked, that the expense of mining here, and of freighting the product, will be materially diminished after the completion of the road to the landing, and the ship-canal at Saut Ste. Marie. It seems to be especially proper to remark, farther, that by sinking two additional shafts, and opening the mine in a corresponding manner, three times the present number of miners (35) might be profitably employed, and the business of stamping, and the product of "mass copper" and barrel work, rateably increased. Experience and analogy would infer a still greater increase as the work extends downward. At all events, nothing can be more reasonable than to conclude that such an enlargement would increase the net profits in a greater ratio than it would additional expenses. Owing to the falling-off of the bluff, shafts and drifts might be sunk and driven, west of the main shaft B, in the space of nine months, so as to allow of the employment of twenty additional miners in section 2, and in nine months thereafter, section 3, or the adit level, might be reached with the shafts, and as many as twenty more miners might then be profitably employed in that section; and as soon as the drifts connecting shaft B with the shafts now proposed, should be run (which might be done very shortly after carrying the new shafts to the adit level), more than a hundred miners might be employed to excellent advantage, in stoping and sinking, still further down. To make such an enlargement as economy and self-interest would dictate, it would be necessary to sink 733 feet of additional shafts, and drive 3,700 feet of additional drifts, or as near these amounts as can be calculated so far in advance, namely,

8 feet to carry shaft B to the bottom of section 4, costing $12 per foot,	$96
300 feet to carry the proposed shaft G to the same depth, costing $12 per foot,	3,600
250 " " " " " " " E	3,000
180 " " " " " " " F	2,260
550 feet of drifting, in section 2, to connect shaft E with the drift from shaft A, at $9,	4,950
950 feet of drifting, in section 3, to connect shaft F with the drift from shaft B, at $9,	8,550
1,200 feet of drifting, in section 4, from shaft B to shaft F, at $9,	10,800
1,000 feet of drifting, in sections 3 and 4, east of shaft B, at $9,	9,000
Total,	$42,096

The mine now has ten dwelling-houses, a store and office, a store-house, a copper-house, a barn, a blacksmith's shop well furnished with tools, a steam saw and stamping mill, a steam-engine of 40-horse power, in fine order, a railroad connecting the lower adit with the stamping-mill, land enough already under improvement to supply vegetables for the men, and hay nearly sufficient for the teams, and another year will be quite sufficient for that purpose. It has also on hand three pair of horses, and three yoke of oxen, with full equipments, besides a valuable quantity of general supplies. Furthermore, the road to the landing is getting fair most of the way, and will soon be a good one the whole distance. Arrangements are also being concerted by citizens of Ontonagon, for running a steamboat on the river, from the lake to the landing of the American Mining Company.

WILLIAM WARNER.

JOURNAL OF SILVER AND LEAD MINING OPERATIONS.

SILVER IN CALIFORNIA.

In the report of Prof. Trask of California is the following notice of the indications for silver in the coast range of mountains:—

In the county Monterey, this metal occurs in the form of argentiferous galena (or lead and silver). This mineral is found in the primitive and transition limestone abounding in this section; it is found in small veins and disseminated; the range in which it occurs extends from the Gabilan Peak to the Chapedero on the south, a distance of twelve miles inclusive. The limestone in which it is found, and the granitic rocks adjoining, have been disturbed by the intrusion of trappean rocks to the east, and from the opportunity that was offered for its examination it dips under the valley of the west at a considerable angle. A cross-cut has been driven from the west side of the hill for the purpose of intersecting the line of the view, but was abandoned before reaching the limestone. A shaft has also been sunk on the vein to the depth of fifty-five feet, and at the bottom the granite had been reached, an opportunity was presented in the level from the bottom of the shaft to make an examination on its line of strike, and from all that could be seen (as there had been much caving in of the walls) it is evident that the metallic vein is confined to the calcareous rock, as no vestige of it was to be found in any part of the granite below it.

At one point the decomposed vein showed a power of four or five inches for two feet in depth; this was followed down to the granite, and at its junction all traces of the vein ceased to exist. It is not improbable that a well defined sett may be found under the valley, but it will require much exploration and expenditure of capital to determine that point, as mining operations cannot be entered upon with small means and ultimate prospects of success.

Traces of this mineral are to be met with for several miles north and south of this locality, and its distribution over so wide a range of country induces a belief that a profitable vein may yet be found in these mountains.

PARKES'S PROCESS FOR DESILVERIZING LEAD.

This invention is founded on the property possessed by zinc of uniting with the silver contained in argentiferous lead, and when fused together, forming with it an alloy which is readily skimmed off from the surface of the metallic bath. Messrs. Neville & Co., who employ this process of desilverization in their works at Llanelly, conduct the various operations as follows:—

The lead to be desilverized is first fused in a large cast-iron pot similar to those used for Pattinson's process, and by the side of this is placed a much smaller one, in which is melted the zinc to be employed during the operation. When the lead in the large pot has been completely fused, its surface is freed from dross by means of a small perforated iron ladle, and its temperature is then raised to the fusing point of zinc, or nearly so. The melted zinc is now added to the lead in the proportion of from 1¼ to 2 lbs. for every ounce of silver contained per ton of the lead operated on, and the alloy is then well stirred and mixed together for about twenty minutes. When this has been done, the fire is withdrawn from beneath the larger pot, and, in proportion as it cools, a thick scum rises to the surface, and is skimmed off by means of ladles similar to those employed for the ordinary process of crystallization. The alloy thus obtained consists of a mixture of lead and zinc, containing almost the whole of the silver originally present in the lead treated, and is subjected to a process of liquation in an inclined iron retort. By this means a large portion of the lead present is eliminated, whilst the zinc, together with the silver and

traces of lead, remain in the retort. The lead thus separated from the alloy of zinc and silver contains on an average about 6 ounces of silver per ton. On treating this rich lead in an ordinary softening furnace, the zinc which it contains rises to the surface in combination with the silver, and is readily removed by skimming.

The argentiferous alloy remaining in the liquation retort is next removed to a Silesian zinc furnace, in which the zinc is separated by the ordinary process of distillation, and is condensed for further use, whilst the silver remains in the retort in combination with a little lead, and is more or less contaminated with the oxides of lead and zinc.

The silver thus obtained is, with the addition of a little lead, treated in an ordinary refining furnace; whilst the oxides of lead and zinc, which are also argentiferous, are added to the various silver ores smelted in the establishment. At Llanelly, each pot is capable of containing from 6 to 7 tons of lead, and yields from 17 to 18 cwts. of argentiferous skimmings. These skimmings, when treated in the first retort, yield about 80 per cent. of eliquated lead, and 20 per cent. of argentiferous matters, which are passed to the Silesian furnace.

The lead which remains in the larger pot after the removal of the argentiferous skimmings is at once removed to the calcining or improving furnace, from which the products obtained are softened lead and a very small quantity of argentiferous dross, which is added to that formed during the various other stages of the operation.

This method is said to be more economical than crystallization, but it has the disadvantage of not separating the silver quite so effectually as Pattinson's process, and the lead produced is also harder and whiter than that obtained by the ordinary process. The lead treated according to Parkes's patent usually retains about one ounce of silver per ton.

COALS AND COLLIERIES.

ANTHRACITE COAL TRADE FOR 1854.

Shipment from Richmond to close of week ending August 12th,	829,685	tons.
Same time last year,	649,235	"
Increase,	180,450	"
Amount sent by Reading Railroad to August 17th,	1,310,499 17	"
" " Schuylkill Canal,	544,267 16	"
Total,	1,854,767 13	"
To same time last year,	1,469,414 19	"
Increase,	385,352 14	"
Lehigh coal shipment to August 12th,	625,577 08	"
Same time last year,	572,084 06	"
Increase,	53,493 02	"

CUMBERLAND COAL TRADE FOR 1854.

Total to August 12th, 1854,	369,333 16	"
Same time last year,	268,589	"
Increase,	100,744 16	

REPORT OF PENNSYLVANIA COAL COMPANY.

The Board of Directors respectfully submits to the stockholders its annual statement of the business of the Company for the year 1853.

The net profits, as will be seen by the statement annexed, amounted to $358,336.44, or equal to 11¾ per cent. on the capital stock. Two dividends, of five per cent. each, have been declared, leaving a balance of $46,061.44; of which, $40,000 have been appropriated towards sinking the original cost of opening mines, and the residue, $6,061.44, added to the surplus of previous years: leaving a reserved fund to the credit of profit and loss of $138,984.63.

The coal brought to market during the year amounted to 513,000 tons, or 13,000 tons more than was estimated in the last annual report: exceeding the production of the previous year 87,000 tons.

The impracticability of opening mines with sufficient rapidity to obtain the large and increasing supplies the Company has annually brought to market—exceeding, in the fourth year of its business, half a million of tons—necessarily led, for the time being, to the procuring of a portion of the coal by purchase, and at rates more expensive than the cost from the Company's mines. To obviate such a reliance, special and careful attention has been paid to the development of the Company's coal property, by effecting numerous mine openings, from which a largely increased yield has been yearly experienced. These openings are now so far advanced as to enable the Company to realize, during the present and future years, a full supply of coal from its own mines.

The mines in operation are now producing 2,400 tons per day, and with the quantity already mined, would supply, if such amount could be brought down the canal during the present season, upwards of 570,000 tons of coal, while their capacity will be further increased, on the completion of openings still in progress, to an extent equal to an annual supply of at least 800,000 tons.

Additional canal boats and cars have been built, and other requisite facilities provided for an increased business: and it was expected that the production for the present year would be correspondingly augmented, in accordance with the experience of previous years. But the interruptions to canal navigation at the commencement of the season, from injuries to the canal by floods, has greatly interfered with the transportation by this channel, and must necessarily reduce the amount that would be otherwise attainable. To retrieve as far as possible the time thus lost, the most energetic measures have been adopted; and from the arrangements made for a vigorous prosecution of this banch of the business, it is confidently anticipated that the canal transportation will not, even under the disadvantages adverted to, fall short of that of last year; and as the prices received for coal are much more remunerative, the business of the year, in the opinion of the Board, cannot be otherwise than highly prosperous: while the prospects of the Company for future years are of the most gratifying character.

The rapidly increased demand in this market for anthracite coal seems to exceed the supply by the existing means of transportation, and must, even with those which are in progress, as expressed in the last annual statement, continue to an extent to insure favorable sales during future years for all the coal which can be mined and brought to market. JOHN EWEN, *President.*

New York, July 27, 1854.

Statement of the business of the Pennsylvania Coal Company for the Year ending May 1st, 1854.

Dr.		Cr.	
To coal on hand per last report, and cost of coal mined, &c., in 1853,	$557,013.36	By sales of coal to May 1, 1854,	$2,138,005.43
" road expenses,	306,161.50	" amount received for transportation of merchandise over Company's road, profits on lumber, barges, &c.,	32,543.36
" freight and tolls on canal,	810,754.53	" balance of interest account,	20,398.16
" Port Ewen expenses,	57,746.73	" coal on hand,	84,938.91
" salaries, current expenses, &c., New York office,	24,334.78		
" interest on $600,000 mortgage bonds,	42,000.00		
" coal yard and harbor expenses, rents, depreciation of tools, implements, &c.,	109,491.42		
" tax paid State of Pennsylvania,	14,986.50		
" balance,	353,336.46		
	$2,375,885.86		$2,375,885.86
		By balance,	$353,336.44

GEO. A. HOYT, *Treasurer.*

Dr. *The Pennsylvania Coal Company in acct. with the Treasurer, May 1st, 1854.* Cr.

To capital stock,.....		$2,145,800.00	By real estate, docks, &c.,.....		$1,021,770.98
" 7 per cent. mortgage bonds,.....		900,000.00	" canal boats,.....		482,987.14
" bonds and mortgages payable,.....		102,186.75	" barges and steamboats "Pittston" and "Telegraph,".....		86,280.54
" bills and accounts payable,.....		906,615.96	" opening mines,.....		272,569.93
" balance per last report,.....	$303,923.19		" railroad,.....		1,900,897.67
Earnings of 1853, per statement,...	353,236.44		" sundry disbursements on account of business of 1854, &c.,.....		199,579.95
	$656,959.63		" balance due from Delaware and Hudson Canal Company, on business of 1850 and '51, not including interest, &c.,.....		95,002.13
Less credited opening mines, $20,000			" balances in hands of agents of the Company,		68,593.01
Dividend paid Aug. 5, 1853, 150,000			" bills and accounts receivable,.....		147,188.77
" " Feb. 10, 1854, 150,000	320,000.00	336,959.63	" cash on hand and loans on call,.....		67,966.27
Balance,.....	$336,959.63		" coal on hand, tools, &c.,.....		96,867.90
		$4,290,561.64			$4,290,561.64
			By balance,.....		$336,959.63

Geo. A. Hoyt, *Treasurer.*

LACKAWANNA COAL REGION.

The general reader will find some interesting facts in the subjoined extract from a correspondent of a Western journal, relative to the manner of forwarding coal to market from the Lackawanna region; neither will they be devoid of importance to those more immediately connected with this business.

The coal crops out everywhere—on the tops of the highest hills, in the gullies, and on the level. The abundance of this mineral can be judged of from the fact, that no one puts the product of an acre of coal land at less than 70,000 tons—the thickness of workable coal being stated at from 75 to 100 feet. As for the extent of the coal supply of this basin alone, you can judge from the fact, that it is over forty miles in length by four in breadth, and is literally full of coal. Hardly an acre is without it. The quality of the coal varies somewhat. That in the immediate vicinity of Scranton, though good and of fine quality, is not equal to the coal of the eastern end of the basin, which again is inferior to that of the western portion. To what causes these differences are to be ascribed, I am ignorant—but so they differ, and this difference led to the quarrel and lawsuit between the Delaware and Hudson Canal Company and the Pennsylvania Coal Company. The latter Company mine their coal at Pittston, and by their railroad, run by gravity, (that is, the line of the road follows the mountain face on the south side of the basin, and the cars alternately run down slopes of 40 feet to the mile, "*full split*," and having reached the bottom of the slope, are hauled up the hill again by a stationary steam engine. This process is repeated 17 times in 45 miles, and affords a cheap and quick transportation.) I say their coal is run to the Delaware and Hudson Canal, at Hawley, whence it goes by boats to New York. The transportation on the canal is done under a contract, made when the Delaware and Hudson Canal Company were keeping the Eastern market fully supplied with its coal, and nothing was known of better coal being west, nor was it dreamed that the small concern just then forming would ever harm the mighty Canal Company. But as soon as the Pennsylvania Coal Company got into operation, the superiority of its fuel attracted attention. It took the market, and had a preference everywhere over the coal of the Canal Company. A quarrel grew up, which has increased yearly, till now the Canal Company will not permit a boat loaded with the coal of the Pennsylvania Company to pass the first lock till the toll for the entire distance to the Hudson is paid down in a New York certified check. To avoid delay, a daily payment is made of the entire day's shipment. But the public are to be benefitted after all. For while litigation was progressing between the Companies, the Pennsylvania Coal Company, fearing they might lose their suit, and get cut off from the use of the Canal, got a change in their charter, to enable them to run a new Gravity Railroad from this valley to the city of New York direct, and are now surveying the route, and find that a car started here will, of its own weight, run to within some thirty miles of the

metropolis. When this improvement is completed, New York will have cheap coal. For there the Delaware and Hudson Canal Company, the Pennsylvania Coal Company, and the Scranton Coal Company, will meet, and contend for the market. Their struggle and competition will tend to give uniformity to the price of coal. And so, to a certain extent, will the Scranton coal contend in Buffalo and the West, with the Canal coal from Wilkesbarre and Pittston. This canal runs along the margin of the Susquehanna river, and at almost every half mile of its distance through the coal fields, stand the fixtures of a coal mine. Frequently, several are in sight at once. The citizens are all looking forward with impatience for the opening of the new piece of canal in the State of New York, which is to connect with the Chemung Canal at Elmira, and this Pennsylvania Canal at the State line. It is now nearly ready for operation, but will hardly do much this year.

BROAD TOP COAL REGION.

On page 327, Vol. II., will be found a notice of the Company's constructing works in order to send coal from the Broad Top region In these days of uncertain prices in the coal market, every thing is of interest which has a bearing upon the means for future supply. The following estimates furnish some further intelligence relative to the cost of coal from this region, either to New York or Philadelphia:—

The work on the Huntingdon and Broad Top Railroad, which is to connect Philadelphia with the Broad Top Mountain coal-field, is progressing most rapidly, and the Directors have every assurance that before the first of January next, the work will be in such a state of forwardness as to enable the miners to transport coal to this market. The Broad Top coal region is one of the most interesting localities in our State, and as an addition to the means of supplying the greatly increased demand for an article so important to all communities, it presents inducements for investment, either in lands or mining operations, which are seldom to be met with. The road which is to render these lands productive by affording a means of transportation for the rich deposit within them, is from twenty-four to thirty miles in length, and, as we learn from our informant, some sixteen miles of it are already prepared for the superstructure, while the remaining sections are in a great state of forwardness.

During the season for navigation, the Broad Top region, like the Schuylkill, will have the benefit of two channels of communication with our city, and the markets of the South, the North, and the East. By the Pennsylvania Railroad in connection with the road now building, coal can be started from the mines and landed in Philadelphia within twenty-four hours of the time of its departure, and during the first months of the development of the region, which will be in the coming winter, this will, of course, be the avenue used for transportation. During the boating season, the State Canals, in conjunction with either the "Tide-Water," or the Union and Schuylkill Canals, will be the avenues used for this trade, in consideration of the cheaper rate at which they can be used, and the absence of a necessity for transhipment of such coal as may be destined for the New York or neighboring markets.

In referring to this subject, some months back, we noticed the fact that Mr. Matthew W. Baldwin, the celebrated locomotive builder, after giving the coal a fair trial, had pronounced it superior for steam purposes to any anthracite ever used in his extensive establishment; and we are informed by reliable judges and practical consumers of coal, that, as compared with the Cumberland coal, now extensively used in New York for steam purposes, it has a decided advantage over that article. This fact has led us to a comparison of the cost at which the coal from the Broad Top and the Cumberland regions can be placed in the two markets of Philadelphia and New York. As the

latter city is the principal market for the Cumberland coal, we give the distances from the two regions to New York as follows:—

CUMBERLAND MINES TO NEW YORK.

	Miles.
From mines at Cumberland to Baltimore by railroad,	188
By Chesapeake Bay to Canal,	54
Chesapeake and Delaware Canal to Delaware City,	38
Delaware City to Philadelphia River,	41
Philadelphia to New York by Canal and Bay,	118
Total number of miles,	439

BROAD TOP MINES TO NEW YORK.

Broad Top to Huntingdon, Railroad,	28
Huntingdon to Middletown, State Canal,	100
Middletown to Reading, Union Canal,	80
Reading to Philadelphia, Schuylkill Canal,	60
Philadelphia to New York, as before,	118
Total number of miles,	385
Difference in favor of Broad Top region,	54

In addition to this, it should be noticed that a hundred and fifty miles of canal transportation is substituted for railroad (between Cumberland and Baltimore), which is, of course, in favor of the Broad Top field. These figures show conclusively, that to the extent of the supply from the Broad Top region, it must entirely take the place of the Cumberland coal, in either our own or the New York market. The Broad Top coal is, in geological parlance, termed semi-anthracite, and is therefore of decidedly more value for all purposes for which it is required, than is the anthracite from either the Schuylkill or the Wyoming regions; and with a view to ascertain the price at which it can be placed in our city or that of New York, we give the following figures, obtained from a reliable source. It should be remarked, however, the freights and tolls are for the commencement of the year, and subject to increase as the season advances.

COST OF COAL FROM BROAD TOP TO NEW YORK OR PHILADELPHIA.

Rent of mines per ton,	25
Timber, say,	10
Cost of mining,	40
Freight and toll, railroad, to Huntingdon,	50
Shipping from cars to boats,	10
Tolls, Pennsylvania Canal to Middletown, 100 miles, ½ cent,	50
Freight, ditto, ½ cent,	50
Toll, Union Canal, 80 miles, ½ cent,	40
Freight, Union Canal, 80 miles, ½ cent,	40
Toll, Schuylkill Canal, 60 miles,	30
Freight, Schuylkill Canal, 60 miles,	30
Contingent labor,	25
Cost in Philadelphia,	$4.00
Add freight and toll from Philadelphia to New York, say,	1.25
Cost laid down in New York,	$5.25

These figures, although exceedingly liberal, and which bear increasing according to the demand for coal, as compared with the advanced rates of carriage, prove conclusively the fact that a market stands open for the Broad Top coal to any extent to which the region is likely to be productive for years. Indeed there is an absolute vacuum for coal of this description which cannot now be filled, and the prospects are, therefore, that the pioneers in this trade are destined to reap an abundant and rich harvest for their enterprise.

The owners of the lands in this coal field are now, in many cases, actively engaged in opening and preparing them for operation; and we were some days since shown samples, in addition to those heretofore noticed in our *paper*, which are of a most beautiful and superior character. We understand

that a company is now being organized, under the general improvement law of the State, for the purpose of opening their lands and preparing for leases, and that the gentlemen engaged in its formation propose to be ready for an active business immediately on the opening of the Huntingdon and Broad Top Mountain road, which we are assured will be ready the first of January next.

COAL IN THE VALLEY OF THE OHIO.

Many facts have been given in these pages respecting the probable supply of coal in the valley of the Ohio, whilst the subject of the demand has hardly been entered upon; indeed, the best estimates upon this point must, for some time yet, be regarded as indefinite; they still, however, contain some reliable data worthy of attention. The following estimates and remarks are made with reference to the demand below Louisville, and are put forth in the *Louisville Courier*:—

The demand in that region is said to be one million one hundred and seventy-five thousand tons, and the supply only about one hundred and fifty thousand tons. The demand in the Valley of the Ohio, and lower Mississippi, last year, we find stated at three millions and a half of tons, and the gross supply fell short of one million and a half.

It will be shown that the present production compared with the present demand for supplying steam-boats alone (leaving out the requirements of the Louisiana sugar-houses, 1437 in number, 958 of which employ steam), the several cities and towns between Louisville and New Orleans, besides the incalculable quantities that will be required at New Orleans to supply lines of steamships plying to Europe, Havana, Vera Cruz, the North, &c., is in the bowels of the earth and at points alluded to, and only requires capital, miners, and energy to be developed, and transported to depots at Cairo, Memphis, Napoleon, Vicksburg, Natchez, Baton Rouge, and New Orleans. It may be argued that the coal interest below Louisville will be interfered with by an increased production of the mines on the Ohio between Pittsburg and Pomeroy—that increase is very considerable, but the consumption has increased and will continue to increase in a great ratio, as shown in the fact that the value or prices of coals have advanced materially.

There is yet to come an immense *interior* demand (not yet estimated) in all our Western States, as our railroads are completed. One great object of the projectors of the railroads from Mobile to Cairo, intersecting the great Illinois Central Railroad, was to reach the coal region in Kentucky and Illinois, and to obtain coal cheap (for keeping up a depot) for supplying lines of steamships; and it is all important to the commerce of Mobile that the enterprise should succeed. It is not assuming too much to say that the very existence of the *present* commerce of New Orleans, to say nothing of the *future*, depends more upon taking measures for the ways and means for an ample supply of coal at cheap rates to meet the steamship demand, than does the success of all her railroads projected or that may be projected. New Orleans cannot be supplied from Pennsylvania and Maryland coal regions. Bituminous coal at Philadelphia and Baltimore is quoted at $6 per ton, by the cargo, or 20 to 21 cents per bushel—transportation not less than 11, say 32 cents at New Orleans—while it is 10 cents at the mines below Louisville—transportation 7 cents, including a per centage for loss in the transportation, cost at New Orleans say 17 cents per bushel. Besides, coal, coal lands, and sound coal stocks, are all advancing at the North, notwithstanding a stringent money market. Why is this? Answer: the consumption is advancing in a greater ratio than the production; and will continue to do so; and so it will be in the West and South. The time is not far distant when *Louisville will consider coal reasonable at 20 cents per bushel*, and a reduction from that figure [illegible]

only be brought about by an ability on the part of dealers in approaching near to supplying the steamboats and the South from the coal fields *below* Louisville. So lucrative is the business of shipping coals from the several mines on the Ohio *above* Louisville to New Orleans and the towns on the Mississippi, that even to obtain 15 cents per bushel at Louisville on arrival is no object. Boat-loads of coal have been purchased at Louisville this season at 14 and 15 cents per bushel and sent below, and large profits realized.

In order to demonstate the economy of coal over wood as fuel for steamers, we will state a plain case. For instance, the average consumption of the steamer Eclipse on a trip from Louisville to New Orleans and back is 1,100 cords of wood, the average cost is $3.25. Say that the coal at the mines at 10 cents per bushel, at Cairo at 13 cents, at Memphis, Napoleon, and Baton Rouge at 20 cents, and at New Orleans 25 cents, the average is 17 cents per bushel, and that 10 bushels are equal to one cord of wood, she would require then on a trip 14,300 bushels.

1,100 cords of wood at $3.25,	$3,575
14,300 bushels of coal at 17 cents,	2,431
	$1,144

One thousand one hundred and forty-four dollars per trip, or fourteen thousand eight hundred and seventy-two dollars in a season of 13 trips; and as at least one trip may be gained by the time saved in not wooding, it is fair to add $5,128 gain in the extra trip; making a total gain in the season of $20,000 dollars. This annual saving on a boat's life-time (six years), with interest added, would be equal to the original cost of said boat.

An estimate of the consumption of coal, if entirely used by steamers running between the following points on the Ohio, Mississippi, Cumberland, and Tennessee rivers:

		Bushels.
From Louisville to New Orleans, 19 steamers, consumption per season,	.	2,015,424
From Louisville to St. Louis,	7	600,000
From Cincinnati to St. Louis, Memphis, New Orleans, and Nashville,	65	1,879,200
From St. Louis to New Orleans,	9	867,620
From Memphis to New Orleans,	4	302,400
From Vicksburg to New Orleans,	4	201,600
From Red River packets,	.	75,000
From Arkansas packets,	.	100,000
From Natchez to New Orleans,	2	103,000
From Natchez to Bayou Sara,	2	78,800
Coast boats,	3	216,000
From Cumberland and Tennessee Rivers to New Orleans,	.	818,700
Boats plying irregularly from points above Louisville to St. Louis, New Orleans, and regular packets between Louisville, Cumberland, and Tennessee rivers,	.	1,742,780
		9,000,000

The estimate of the consumption of coal, to its equivalent in wood, is as 12 bushels to the cord, which is about a fair estimate when furnaces are properly constructed for burning coal.

The following are some of the advantages to be derived by the use of coal *instead of wood*:—

1st. Coal is less than one-half the weight of its equivalent in wood.

2d. Coal will occupy but a small portion of the deck and guards of the steamer, when compared to its equivalent in wood.

3d. The wear and tear of the steamer's guards and decks will be much lessened by the use of coal instead of wood.

4th. By the use of coal, there will be no sparks proceeding from the chimneys or furnaces of steamers, nor any wood-pile to catch fire, which is of frequent occurrence in burning wood. It must therefore be evident that disasters by fire will be much lessened, particularly with boats carrying *cotton* or *other combustible material.*

5th. By the entire use of coal, so far as the actual firing is concerned for the generation of steam, not more than *one-half* the number of firemen would be required, when compared with the burning of wood.

6th. With a proper and well arranged plan for taking coal on board of steamers, I think that about *one-half* the time would only be required than would be necessary for taking on its equivalent of wood.

7th. The saving by the use of coal, instead of wood, will of course be the difference in the cost of each, which will be found by investigation to be largely in favor of coal.

Some portions of the above estimate had, of course, to be made without any positive data, but the estimate will, I think, be found nearly correct.

Respectfully, JOHN SHALLCROSS.

The estimate for a daily supply for steamers touching at Cairo, is 50,000 bushels. I can now show that the total annual supply required (below the city of Louisville), which I find to be thirty-five millions of bushels, or one hundred and forty thousand bushels be mined per day in place of the present mining, twenty thousand bushels: so that an increase of seven hundred per cent. is required to meet the *present* demand.

RECAPITULATION.

	Bushels.
For steamers as per Captain Shallcross,	9,000,000
For sugar-houses,	11,471,376
For New Orleans (city consumption),	2,350,000
For New Orleans for her steam marine,	3,650,000
For towns and cities from Cloverport to New Orleans,	3,429,624
For General Government for supplies on the Gulf,	3,000,000
	35,000,000

The foregoing tables and comments in relation to the coal trade of *the lower Ohio*, must bring the minds of men of enterprise and capital to the conclusion, that in this field better opportunities can be found for largely more profitable operations than were ever presented by the *gold fields of California*—a present supply of 20,000 bushels per day, or 4,800,000 per annum, and a *present demand* of 35,000,000 bushels, about 140,000 bushels per day, requiring only that companies with capital and enterprise should make investments in them, in order to insure the realizing of profits beyond the profits to be afforded by any other safe business in the world.

When a supply of coal for steam-propellers can be furnished *at twenty-five cents per bushel*, it will be to that city "a good time come;" then will she reclaim a good portion of her former heavy receipts of Western produce destined for the Northern and European markets. Coal at 25 cents would enable steam-propellers to compete with the sail vessels in rate of freights; then freight from Cincinnati could be delivered at the Northern markets, via New Orleans, in as quick time as they are now conveyed by our interior routes—15 to 20 days—and *many* would give the Southern route the preference, as it requires but one transhipment. An amply supply of coal would bring an ample supply of steamship tonnage; and then would follow an increased business for our New Orleans steamers. It is fallacious to argue that a railroad communication between Louisville and New Orleans will *ever* interfere with the carrying business on the river. A cheap and reliable supply of coal at New Orleans will be the *bread of her future commerce.*

COAL IN OREGON.

Tertiary coal exists in vast beds on the Cowlitz river, and, according to Lieut. Abert, bituminous coal occurs on the Rocky Mountains, near the Raton Pass, in latitude 37 deg. 15 sec., and longitude 104 deg. 35 sec.; while Col. Fremont reports inconsiderable beds of coal near Muddy river, in latitude 41½ deg., and longitude 111 deg. But the most profitable bed of coal with which

I am acquainted, is situated on or near the banks of a creek, about fifteen miles below Ranier, on the Columbia river. The surface earth is of a brown red cast, occasionally covered in patches with yellow flowers. A little below the surface is a species of sulphurous carboniferous matter resembling coal, but not the genuine article itself. Below this are alternate layers of gravel, red sandstone, called freestone, the red color of which is caused by the red oxide of iron being mixed in its formation; and, deeper yet, the true coal is found. Capitalists, farmers, and others, might unite their means, and the wooden country of Oregon prove a means of enriching its inhabitants by its minerals, and, as yet, hardly known wealth. On the Upper Columbia there is a vast extent of coal beds, but I have not tested the coal of that region, and cannot write so decisively respecting it.

New coal mines are reported to have been discovered at Coose Bay. The coal is thought to be far superior to any yet found there. It burns freely, with a bright flame, leaving little ashes and no cinder.

ACCIDENTS IN COAL MINES.

We have received from Mr. Matthias Dunn, Government Mine Inspector, the following return of fatal accidents which have occurred in his district—the counties of Durham, Northumberland, and Cumberland—for each half-year since the passing of the Mine Inspection Act, in Nov., 1850, which account must be taken along with a progressive increase in the production of coals, and which appears to speak well for the working of the Act, and for the gradual improvement of matters in this district:—

Half year ending—	In shafts.	Explosions.	Choke damp.	Fall of stone and coal.	Sundries.	Total.
June 30, 1851,	13	8	1	21	29	72
Dec. 31, 1851,	5	49	—	15	19	88
June 30, 1852,	17	33	1	19	27	97
Dec. 31, 1852,	11	5	—	26	16	58
June 30, 1853,	12	7	—	28	32	79
Dec. 31, 1853,	17	12	1	30	12	72
June 30, 1854,	9	4	1	21	21	56
Total,	84	118	4	160	156	522
Average,	12	17	½	23	22	75

—*London Mining Journal.*

VENTILATION OF MINES.

Mr. Herbert Mackworth recently stated that, from information he had access to, he thought there was every probability the lives of the miners in the majority of coal mines, in the iron, tin, copper, and lead mines, were shortened from 12 to 15 years on an average, by causes which were in a great measure removable. In some mines, where the ventilation had been improved, the men acknowledged they could do one-fourth more work. As an instance, he mentioned that at the United Mines in Cornwall, last year, there were three sets of men driving a level at a cost of 17*l.* per fathom; the temperature was 105°, and the men changed every five minutes. At the request of Mr. Williams, M. P., he visited the mine, and pointed out how a quantity of air might be introduced sufficient to reduce the temperature to 70°, or less. His suggestions had been adopted, and the temperature had been since reduced to 75°, and the level costing 5*l.* per fathom, instead of 17*l.*

ASCENDING AND DESCENDING MINES.

Mr. Jas. Marlor, coal agent, Oldham, has patented some improvements in ascending and descending mines and shafts, and in the apparatus connected therewith, by which said improvements the ventilation of mines is increased,

The inventor places in the mine tubes extending from the top to the bottom, and in these tubes he places cages formed in the ordinary manner, except that in the crown of each of them there are two or more valves opening inward, and at the edges or sides of the crown a number of lateral valves, so fixed that they may be pressed outwards and against the inner sides of the tube by the pressure of the air contained in the tube during the descent of the cage, the two valves in the crown being forced upwards and closed by a similar pressure.

COAL IN RUSSIA.

Sir Roderick Murchison, referring to an extract from the *Monitour*, copied into the *Times*, in which it is asserted, on the authority of a letter from Leipsic, that he "had not hesitated to declare that the discovery of a coal mine in Russia was impossible," has forwarded the following particulars, in contradiction of that erroneous statement, and to explain his views on the subject:—"In 1840–41, and after my first journey in Russia, I pointed out the simple but important fact, that throughout the Baltic provinces and extensive northern tracts, the formations which were at or near the surface were of remoter antiquity than the great coal-bearing strata, and that, not containing any traces of fossil vegetables out of which coal could have been produced, it was quite impossible to obtain the mineral by sinking shafts in that region. At the same time, assisted by my French colleague, M. de Verneuil, and aided by the Imperial mining engineers, Col. Helmersen and Count Keyserling, I indicated the position and nature of two or three thin seams of ill-consolidated impure coal, which are visible, at intervals, in the lowest member of the carboniferous rocks, both in the Valdai Hills and near Tula and Kaluga. A sectional view of one of these examples, as occurring in the Valdai Hills, about 125 versts to the south of St. Petersburg, which was given in the large work of my colleagues and self, and has recently been reproduced in my work entitled *Siluria* (page 328), is, I suspect, the 'coal mine' spoken of as having been lately discovered near the capital—though its existence has long been a matter of notoriety. Tracing these slightly carbonaceous strata to the great Lake Onega, my companions and myself indicated how such strata there thinned out into mere bituminous shale, and how all traces of them disappeared before we reached the banks of the great river Dwina and the shores of the White Sea near Archangel. But even then I adverted to a productive coal field in the country to the north of the Sea of Azof, or about 500 versts to the south of Moscow. Researches pursued in subsequent years (1841 to 1844 inclusive) confirmed my views and extended my inference respecting the absence of any coal worthy of national attention over other regions larger than France and the British Isles united, whether as subtending the Ural Mountains or in the territories of Orenburg, Kazan, and Astrakan. This opinion was unreservedly expressed at the time to the Imperial Government, and, on my return home, to my associates in science. The southern coal field, however, or that which is watered by the river Donetz, was again specially excepted, and a description of its peculiar phenomena and the disturbed condition of its strata, the result of a personal survey with M. de Verneuil, was given in the work entitled *Russia and the Ural Mountains*, accompanied by some speculations of my own on the ulterior prospects of that mineral tract. The statist and miner who wish to obtain accurate detailed knowledge respecting this coal field, most of the beds of which are anthracitic, must consult an excellent memoir thereon by M. Le Play, an eminent French mining engineer, who explored that portion of the south of Russia for M. Anatole Demidoff."

IRON AND ZINC.

ON AN IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

Scientific revolutions are always caused, writes M. August Langel, of Paris, by the discovery of some entirely new principle: industrial ones, by a new and happy application of principles long known, but from which all the results have not yet been obtained.

I propose in this brief memoir to demonstrate the possibility of an industrial revolution in the United States with regard to the manufacture of cast-iron, iron, and steel.

A few historical considerations must first be presented. It is universally known, that iron was at first manufactured exclusively by means of charcoal with apparatus of small dimensions. This method precluded the preparation of large quantities, and it became quite insufficient when the introduction of steam-engines gave to industry so much wider a field. The immense importance of coal began to be recognized, and iron was manufactured by its means, according to new methods, which favored its more rapid production in greater quantities.

A rivalry thus commenced between the coal foundries and those kept up by wood, in which the latter were evidently to be overcome. The nations possessing great coal districts, particularly Great Britain, became the producers of iron for all the rest.

In these circumstances, if suddenly there should be discovered a new means of making iron with wood as rapidly and as economically as it is done at present with coal; if, besides, the iron thus prepared should offer in quality very great advantages in comparison with that made with coal, is it not natural to suppose, that the consumers who are only attracted by the cheapness of English iron would cease to employ it? Even admitting that under certain circumstances this iron would be dearer, they could more advantageously use it for those purposes for which iron of the first quality is indispensable, such as the manufacture of steel.

The country best situated for the success of this industrial revolution, is, undoubtedly, the United States of America. For example, wood is found there in great quantities, and may, in some places, be obtained at a very low price; on the other hand, the beds of mineral-iron are very numerous; modes of transport, always important in the working of iron, exist in great numbers: here we find all the conditions necessary to success. It remains only to establish with certainty the advantage of this new method of manufacturing iron, and to explain its high importance.

1st. Wood is not charged with those mineral substances, which injure at once the calorific effect, and the quality of the metals fabricated by it. Coal contains often ten per cent. of matters either useless or injurious. Wood, on the contrary, contains hardly ½ per cent. of mineral substances, which, besides, are never injurious. All wood has great chemical uniformity, while coals differ much from each other, which involves the disagreeable necessity of ranging the methods of employing them. It is well known to metallurgists, that wood should not be employed as a combustible, without previous preparation, on account of the large proportion of water which it contains.

For many years, the most various experiments have been made to prepare the wood before using it as a combustible. The method to which we would now call attention, has been used for a very short time in Styria and Carinthia, which consists in taking from the wood only the water, and stopping the distillation as soon as the substances which escape begin to contain carbon. Two methods have been used to effect this conversion of wood into *ligneux* (lignum).

* It is unnecessary in this memoir to describe either the chamber in which this process takes place, or the requisite apparatus and details of the different processes.

1st. The gases coming from the fire-place are brought into immediate contact with the wood; thus the wood is raised to a temperature above 100° Centigrade, which favors still more the vaporization by the tendency the gases themselves have to be saturated with vapor.*

In the second method, only the heat radiating from the gases in the fire-place is employed. These gases are not brought into immediate contact with the wood, but are conducted in pipes of cast or sheet-iron, around which the wood is piled.

The second method affords by far the most satisfactory results; being the more economical, and avoiding the disadvantage which sometimes attends the first, of making the *ligneux* pyrophoric, and thereby liable to spontaneous combustion on exposure to the air.

It is important to render the second method still more perfect: the following means might be advantageously employed; the combustion of the wood employed effects the conversion into *ligneux* which is thus raised to a temperature of 150° Centigrade. All the water contained in this wood escapes in vapor, but the heat contained in this vapor and in the *ligneux* should be made useful as well as the latent heat contained in the vapor. For this, three successive chambers will be necessary; the wood loaded on wagons passes in succession from one chamber to another; in the first chamber the wood will begin to be heated and to dry by means of the latent heat of the vapor, disengaged in the second, and condensed in the third, and also by means of the latent heat of the air, cooled in the third and brought back to the first. It is in the second chamber that the entire conversion of the wood into *ligneux* takes place: the *ligneux* will pass into the third chamber to cool; the heated air will be conducted to the first chamber to heat another load of wood; the vapor which is found there, and which comes overheated from the second chamber, will be condensed, and thus will give more heat to the first chamber, with which it communicates by pipes.

In following the preceding method, it is possible to change 10 parts of wood (standing for 1·00 of *ligneux*, 0·40 of water) into *ligneux*, by means of one part of wood employed as a combustible.

There is another method more economical, which might be employed to convert the wood into *ligneux;* it consists in utilizing the wasted flame of the metallurgic apparatus, after having, of course, previously used it for other purposes—for example, heating the cauldrons—because, on coming from the apparatus, the gas is of too high a temperature for the operation in question, and is still sufficiently hot after having been employed for the previous processes. But this method by which economy is carried to the utmost extent, though very suitable in France or Germany, does not seem necessary in America, on account of the cheapness of the vegetable combustible. Thus far we have only explained, and very briefly, the first part of the new method of manufacturing iron. We now come to the second part, which is the *puddling process* with *ligneux;* the puddling, it is well known, is effected by burning in a reverberatory furnace the combustible gases which come from a lateral fire-place: the important part of the operation is, to conduct into the furnace a sufficient quantity of air, to produce a total combustion of the gaseous substances. Generally, too much air is admitted, which has the disadvantage of uselessly absorbing the heat. Mineral combustibles are much better adapted than wood to the operations of the puddling furnace, on account of their superior density; they develop a greater quantity of heat, and also produce a more regular current of gas; besides which, the interstices between the pieces of wood permit too much air to pass. In the new puddling process, the quantity of air introduced into the furnace is, so to speak, mathematically regulated: the combustible mixture and the current of air which serves to ignite it, are admitted separately into the laboratory: here, the fire-place must be of entirely different dimensions. It is very long vertically, the grate is very low, and composed only of a few bars to support the wood: the air no longer enters freely into the fire-place; the bellows

send a graduated current of air under the wood, which traverses it, producing its distillation. On account of the pile which the air is obliged to traverse, this distillation takes place, so to speak, in a gradual and progressive manner: the air thus admitted into the lower part, is in proportion to the quantity of *ligneux* required to be carbonized in a given time. The current of combustible gas which is found in the pile of wood passes into the laboratory, where the puddling takes place, and is met by a current of air carefully regulated and driven through a pipe; thus the laboratory obtains, instead of an ordinary flame, a combustible gas free from all traces of pure oxygen. Nothing is more easy, when one understands the composition of *ligneux*, than to know the exact quantity of air to admit into the furnace. But in what proportion shall the whole amount of this quantity be divided? How much shall go to the furnace and how much to the laboratory? This is a question which experience alone can answer. We can only say in general, that the latter proportion depends upon the more or less combustibility of the mixture of gases, and consequently on the temperature required in the furnace, the rapidity of the distillation, and the operation itself.

This last term has evidently in all cases a limit, which fixes the proportion to be established between these two currents of air. Registers also connect them with each other, which can be managed by the workmen themselves. This mode of combustion is very remarkable, both theoretically and practically; it produces a very great regularity in the labor, and gives a current of very pure gas: the purification of the cast-iron is thus effected under the most favorable circumstances, and even very impure kinds give excellent iron. It is quite otherwise, it is well known, with the ordinary method of puddling with coal; and we may assert in general, that the impurity of iron is attributable less to the cast-iron than to the imperfection of the mode of reviving. In the United States the cast-iron made with wood or anthracite, would never be of a very bad quality;* the admirable perfection of the puddling with *ligneux* would warrant the excellence of the products of the new method. It now remains (and this is the main point) to consider the economical conditions of the question.

The following are the facts of the case, the exactitude of which we will warrant.

The consumption of cast-iron, labor, and *ligneux*, are per ton of iron:—

Cast-iron,		tons 1.242	
Labor	For the puddling,	days 3.86	11.35
	For forging and rolling,	" 4.69	
	Sundry processes,	" 2.80	
Ligneux	For the puddling,	tons 1.20	2.50
	For forging and rolling,	" 1.30	

This estimate may serve to establish the *special* expenses in each particular case: in order to establish the *general* expenses, it will be necessary to obtain information on the following points:—

1st. The purchase of land.

2d. The price of building, materials, stones, bricks, clay, etc., etc.

It will be important, in order to diminish as much as possible the total amount, to choose a situation where wood is cheap and abundant and in the neighborhood of the mines, from whence the ore could be brought at a small expense. (In case it should be preferable *not* to manufacture the cast-iron, this last observation applies to the cast-iron which it would be necessary to buy.) It is also important to take into account the means of transport of the produce to the great industrial markets by canal or railroad. the price of labor, etc., etc.

It would be well perhaps to annex to the establishment, a manufactory

* It remains to be seen, perhaps, if it would not be advantageous to manufacture the cast-iron also with ligneux.

of cast-steel; the *ligneux* would be very suitable for this species of manufacture; and it would be very easy to prepare for this purpose, iron of the best quality. The establishment of the works required by this new method, must be on a very large scale; its success depends almost entirely on the employment of the most economical means of manufacturing *ligneux;* this condition can only be fulfilled by preparing the ligneux in great quantities, and consequently the metallurgic apparatus must be very numerous.

The solution of this problem, which we have been examining, is in the highest degree important to the future progress of industry in the United States. It will enable them to employ to advantage the mineral wealth scattered over their territory, and upon a point of the utmost consequence will render them independent of other nations. It therefore eminently deserves the attention of the metallurgist and the manufacturer.—*Journal of Franklin Institute.*

THE CAMBRIA IRON COMPANY.

The Cambria Iron Company's works are situated at the confluence of the little and great Conemaugh rivers, immediately below the thriving borough of Johnstown, near the western slope of the Alleghany Mountain. The property embraces about twenty-five thousand acres. The lands, with four charcoal furnaces, and other improvements, were purchased a few years ago, when estates of this description were very much deteriorated in value, from the late Dr. P. Shoenberger, for the small sum of three hundred thousand dollars, he investing two-thirds of the amount in stock of the Company. They are accessible by the western division of the Pennsylvania Canal, the Portage railroads of the State, and by the Pennsylvania railroad, which traverse them east and west. The country has been here upheaved by some internal convulsion, and with it, on both sides of a narrow valley, the richest deposits of iron ores, bituminous coal, hydraulic cement, fire-brick clay, and limestone, in strata contiguous to each other.

The principal vein, adjoining the furnace and rolling mill, (carbonate of iron,) lies over the coal measures about two hundred feet above the bed of the Conemaugh, and sixty feet above the tunnel head of the furnaces. It covers an area of one hundred and sixty acres, and contains an inexhaustible deposit of ore, which smelts very freely, requiring but little limestone as a flux. It makes a superior quality of pig, either for forge or foundry. There are five coal veins besides, four above the level of the canal, and a seven-feet vein, below which the Company will have to work with a shaft fifty or sixty feet deep, if ever they should need it. The second vein lies upon a bed of hydraulic cement, which is five feet thick and of good quality, and the third upon a bed of limestone two feet thick, which is used for fluxing the ores in the furnaces. The great advantage of the estate is that it presents one of the most eligible sites for furnaces, rolling mills, foundries, and other iron working establishments, in the world, Nature having provided an exuberant store of wealth, and left it to the art of man to take it out easily, and roll it down to the tunnel head of the furnaces, a labor-saving machine, worked by the power of gravitation.

The Cambria Iron Company has a capital of a million of dollars, fully paid in. It is now administered by the most sagacious and prudent men, such as Messrs. M. Newkirk, President; David Reeves, R. D. Wood, George Trotter, J. H. Shoenberger, G. Heberton Newkirk, and H. M. Watts, as Directors and officers of the Company, who afford a reasonable guarantee to the stockholders of an ample return for their investment.

Besides the four country blast furnaces, which have lately been enlarged and improved, and are now yielding a product of two hundred tons of pigs per week, the Company have nearly completed four other blast furnaces, for smelting with coke the iron ores taken from the face of the hill, and calculated to produce each five thousand tons of pigs per annum, making an aggregate

of about twenty-eight thousand tons per annum. They have also finished a large rolling mill, six hundred by three hundred and fifty feet in extent, in the shape of a cross, with sixty puddling stacks, twelve heating furnaces, four scrap furnaces, etc., and which, when in full operation, will produce more than one hundred tons of railway iron per day, or 30,000 tons per annum. This, we believe, is the largest single mill in existence.

The engine for the four blast furnaces is four hundred horse power. To drive it there are eight boilers to each furnace, thirty-two boilers in all, sixteen of them forty feet long and thirty-six inches in diameter, and sixteen thirty-four feet long and thirty inches in diameter. The steam cylinders are two of twenty-eight inch bore and eight feet stroke, and the blast cylinders are seventy-two inches bore and six feet stroke, making at full speed seventy thousand cubic feet of blast per minute. The fuel for making steam and heating the hot-blast pipes is furnished by the gas extracted from the furnace stack flues below the tunnel head, and ignited under the boilers.

The aggregate horse power of the mill is four hundred and forty, driving four engines. The engine for the squeezers is forty-two inch stroke, eighteen inch bore and eighty horse power; for the roughing rolls it is six feet stroke, twenty-six inch bore, and one hundred and fifty horse power; for the rail mill it is four and a half feet stroke, twenty-six inch bore, and one hundred and fifty horse power; and for driving blowers, shears, pumps, saws, etc., the engine is forty-two inch stroke and sixteen inch bore. There are sixteen boilers of thirty-six inches diameter and forty feet long. The main stack is seventeen feet square at the base, eleven at the top, and one hundred and fifty feet high. The puddling and heating furnaces are of a new model, and work the iron very economically and make it very strong. The whole machinery is of admirable model and workmanship, and came from the celebrated shops of Otis Tufts, of Boston, and the Philadelphia and Pittsburg works.

The boarding houses and tenements for the officers and families of operators, are commodious, and constructed with an eye to architectural proportions and taste, which, we are happy to see, is now more observed in the interior of the State.

In addition to their extensive works, this Company have a foundry in operation capable of making all the castings they require, from the finest machinery up to castings of twenty tons to the piece. They have also a machine shop, with lathes, planers, and other tools for making the machinery for furnaces, rolling mills, and have blacksmith shops on a large scale, and a shop for making patterns, etc. There are also in operation improved machinery for making fire brick and common building brick, which can be turned out at $2.50 a thousand.

We understand the region occupied by the Company's lands abounds in ores, coal, limestone, and all the other necessaries for carrying on the manufacture, in which they are engaged, to an unlimited extent; and we look to this investment of Philadelphia capital, and to the enlightened energy and enterprise of the men who control it, with genuine satisfaction, not only on account of the friends engaged in it, but for the development of the hidden resources of our State, and the beneficial results to the whole country.—*Philadelphia North American.*

IRON ORE AND FURNACES IN OHIO.

The following extracts describing the existence of Black-band ore in Ohio, and the introduction of a cylindrical form for the interior of the blast furnaces, are very general in their statements, but they present us with a new view of the iron business in Ohio. They are from the *Buffalo Democrat*:—

The famous Black-band ore has lately been found in Ohio. It exists in great quantities in Mahoning county, underlying a deposit of coal in at least

two townships, and probably many more. The identity of what was hitherto deemed a worthless bituminous slate, with the famous Black-band, has been but recently ascertained. Very intelligent iron masters, and experienced English, Cornish, Welsh, and American miners, have walked, worked, and bored, over and through this ore for years past, unconscious of the wealth that lay neglected beneath their feet. A Scotch miner, temporarily attached to a blast furnace, recognized his old friend, as flung out from an ore heap by a filler as worthless slate, and speedily had it elevated to the consequence that belongs to this distinguished ore. Simultaneously, Charles Howard, of Ohio, has changed the form of the blast furnace. He has advanced the art of smelting iron ores. He has cheapened the cost of iron, to all consumers of this most valuable of the metals.

In his experience as a founder, he had, in common with other iron-masters, observed that at certain periods in a blast, or otherwise, in the life of a furnace, it produced more metal than at others. With sound, philosophic method, he at once blew out a furnace that he was working, at this period, and examined the inside of it to see what was its condition at the moment of its best performance. He discovered what hundreds of other iron-masters had witnessed before him, that the action of the blast and the power of the heat had worn and enlarged the furnace at the top and at its bottom. But unlike them, he connected this change of shape with the fact of the increased yield of the furnace, and determined that that was the true form in which a furnace should be originally built.

It was precisely *four months and ten days* from the dumping of the first load of stone for Mr. Howard's furnace, to the putting of the blast on it. There was no preliminary heating up of the stack, as is always done by the regular founders. The masons quit work, the furnace was charged, and the blast clapped on to her, and out came the iron. The initiated will appreciate the great changes thus far noticed. The stack is 47 feet high. The base is 25 feet square. The first 18 feet are of standstone, and also built square, and battened on the outside $1\frac{1}{4}$ inches to the foot. It has four arches. The inside of the furnace is carried up perpendicularly—the stone being neatly cut and fitted to a 12-foot circle, to receive the hearth. The 25 feet above the square bottom are circular, and built of fire-brick. The outside wall is 11 inches thick, the inside lining, of brick, 13 inches long, and 11 inches thick, with 11 inches of backing sand between. The entire thickness of the circular portion of the stack is 33 inches. It is hooped around with iron. This furnace thus dispenses with the old-fashioned hearth and bosh. The inside, instead of being drawn in small at the top, is carried up straight, and gives the tunnel head the same diameter as the top of the bosh. The first visible effect of this great innovation is, that the furnace is cool around the bottom, and about the tuyeres. The blast is not kept down by the conical shape customary to all other furnace interiors. The wind enters easily and passes up easily through the stock. Next, the stock will not lodge in this furnace as in others, nor will it fall irregularly and at intervals. If the charging is ready, and the engine steady, the stock must come down steadily. The influence of this, in giving uniformity to the character of the iron, will be appreciated by founders. The increase in the capacity of the furnace to carry burthen will also be noted by them.

The hearth of Howard's furnace is cut circling, and battens fast from the point above the tuyeres, and intersects the lining 16 feet from the bottom stone.

With the very insufficient blast derived from a 14-inch steam cylinder, driving two wind cylinders of 5-feet stroke, and 40-inch bore, this furnace yielded right off, 10 tons a day of dark, coarse-grained iron. It can produce 18 tons a day of mill iron. A furnace previously constructed by Mr. Howard, upon a plan approaching to this, with an 11-feet mouth and 14-feet bosh, is now yielding 25 tons of iron a day, though its materials are so lean as to take 8 tons to the ton of metal.

In close geographical connection with this important improvement in the iron manufacture, is a fact so discreditable, and so aggravating, that a saint, if of the Protection faith, might be expected to swear over it. Upon that black-band ore, across it, past numerous furnaces, past rolling mills, runs the line of the projected railroad from Cleveland to Pittsburg down the Mahoning Valley. We saw announced a few days since the arrival in New York of the president of this road, returned from England, where he had been to purchase several thousand tons of rails. What a shame it is that with superabundant coal, with inexhaustible iron ore and limestone, contiguous to it, and with such men as Howard to build and work her furnaces, Ohio should buy her railroad iron 4,000 miles away from home, instead of making it herself, within her own borders. The act is so irrational, so wasteful, that one is almost tempted to believe, that the purchase in the case of this road was induced by the voluptuous desire to enjoy Paris, and cheaply to visit and pleasantly to lounge through Europe, and not by the wishes or the interests of the stockholders of the corporation.

THE IRON FOUNDRIES OF PITTSBURG.

There are in Pittsburg, at the present time, as nearly as can be ascertained, thirty-eight foundries which cast iron. They may be divided into two classes, those which make chiefly steam engines, and those which make hollow-ware, grates and stoves, heavy and light machinery, car wheels, mill gearing, iron fronts and railing, wagon boxes, sadirons, school furniture, plough castings, decorative and fancy work, and innumerable other useful articles. Of the former there are nine; some very extensively engaged in this branch, while others partake of the business of both classes. In the manufacture of steam engines they consume yearly 3,200 tons of wrought iron, 9,200 of pig iron, employ 640 hands, and produce 120 steam engines every year. Net capital, $549,000. Five of these engine shops have boiler yards attached, producing not less than 250 boilers annually. There are, besides, five more boiler yards in the city, carried on as an independent business. They manufacture 240 boilers per annum, weighing on an average 5,000 lbs. each, employ 130 hands, and have a capital of $125,000.

Of the second class of foundries there are twenty-nine, consuming yearly 19,275 tons of pig, employing 825 hands, and having a net capital of $775,000. Many of these are very extensive, manufacturing the heaviest mill gearing, cotton and sugar mills and presses, copper mining machinery, railroad castings, chilled wheels, shafts, machines for punching, drilling, and planing iron, etc., etc. One owns the patent for drilled rollers, and is the exclusive provider for the whole United States. Another owns the right for Pennsylvania and Maryland to manufacture Fisk's metallic burial cases, which will employ a large number of skilful hands; three have, in connection with their foundries, freight-car factories, and produce 450 per annum; two or three are exclusively engaged in making cotton machinery, and a like number in making grates and stoves; two make locks, latches, scales, and malleable castings. The heaviest establishment of all is the Fort Pitt Works, and deserves a somewhat special mention. Besides their regular heavy and elaborate products, they have done much work for government. Some years since they built two iron steamships, of 400 tons burden each, the "George M. Bibb," submarine propeller for the Gulf of Mexico, and the "Jefferson," revenue cutter, which was taken apart and transported to Lake Ontario, and is, we believe, still living and in active service. From 1842 to 1847, there were cast, bored, and mounted at these works, 633 cannon, weighing 1,787 tons, and 22,189 shot and shell for cannon and howitzers, weighing 541 tons. During the years 1851, 1852, and 1853, they cast and bored seventy-six cannon, weighing 305 tons, and are now engaged on a government order for twenty-one guns of the

heaviest calibre, called "Columbiads," having a ten-inch bore, and throwing a 124-pound shot.

Lieutenant Rodman, of the Army, and for some time connected with this establishment, is the inventor of a new and important principle in the casting of ordnance. The cannon is cast hollow, and a constant and ever-renewed stream of water forced in, thus cooling the interior first, instead of, as was the old plan, casting it solid, and allowing the outside to cool first. The effects are more equal strain, and more density and toughness where such qualities are most needed. Cannon cast by both methods have been subjected to most powerful tests, and the result has been that those cast on the new principle bear five and six times more than those cast by the usual method. In 1853 these works consumed 2,225 tons pig iron, 1,000 tons wrought iron, employed 260 hands, and produced ten blast cylinders, ten large first-class steam-engines, 300 tons boilers, and 150 freight cars, besides other important work. There have been built also, at other works, two steam revenue cutters, one submerged propeller, for Lieutenant Hunter, and one large river steamer, all of iron. Of the fates or condition of these various steamers we have no knowledge. The amount of pig iron, blooms, and scraps, consumed in Pittsburg, would be, from the foregoing estimate, which is as close as can be arrived at,

Steam-engine foundries,	6,250 tons.
All other foundries,	16,275
Rolling mills,	68,850
Total,	127,375

It would be impossible to make any estimate, even approximating the truth, of the amount of wrought iron consumed by the various factories of Pittsburg, but it would rise to many thousand tons. The other manufacturing establishments are quite numerous.

MAGNETIC IRON BEDS OF THE PENOKIE RANGE, ON THE SOUTH SHORE OF LAKE SUPERIOR, IN WISCONSIN.

The most easterly appearance of magnetic iron ore, which was observed by Colonel Whittlesey, was in fissile black slate, about four miles west of the Montreal trail, in section No. 4, west. The bed lies back of the trappose range, about sixteen miles from the Lake, in a protrusion of metamorphic slates. About four miles along the strike of the beds, south-west by west, the bed was seen by W. Randall, in 1848, in the fourth principal meridian, in township 44° north, eighteen miles from the lake. From thence he and his assistant traced it, at moderate intervals, along the uplift, to the west end of "Lac des Anglais," or about fifteen miles, to where the range terminates. Here the metamorphic slates are replaced by syenitic rocks.

There is a continuous bed of iron ore from the meridian westward to Lac des Anglais. Its thickness, richness, and value, vary very much.

On the Pewabic range the strike of the beds is east by north; the dip north by west, 80° to 85°. The beds of quartz are of great thickness—two hundred to two hundred and fifty feet. Near the junction of the quartz and talcose slate, the latter assumes the aspect of novaculite. The iron bed is schistose in its structure, and is composed of magnetic oxide, sometimes alternating with beds of quartz.

The bed of magnetic iron ore, south of Lac des Anglais, is of extraordinary thickness—twenty-five to sixty feet. The proportion of iron and quartz is very variable, but the separation of them by mechanical means would, in general, not be difficult. The bands of ore vary from mere thin laminæ to a thickness of twelve and even eighteen inches, presenting, sometimes, a black surface, contrasting with the white and gray color of the quartz, and sometimes a bright metallic gray color.

There are many places in the mountain, west of Bad River, which present more than fifty feet of quartz and iron, in about equal proportions.

Where the west branch of Tyler's Fork crosses this chain, W. Beesly found the southerly face of the uplifts well charged with a rich, heavy ore, showing thirty-five and seventy feet, with iron predominating over quartz.

All the specimens were of the black magnetic oxide, without any of the red.

The productive yield of such an ore can only be determined by trial, in properly constructed furnaces; but, judging of the specimens by weight, they will afford fifty to sixty per cent. of metal. The following is an analysis of one specimen by Dr. Owen, which yielded the following results:—

ANALYSIS OF SPECIMEN NO. 7, FROM THE SLATY BEDS OF THE MOUNTAIN SOUTH OF LAC DES ANGLAIS.

Peroxide of iron,	51·5	
Protoxide of iron,	27·1	
Mixed oxides of iron,	78·6	56·3—iron.
Silica,	20·8	
Magnesia,	00·6	
Alkali,	00·2	
Fluoric acid,	a trace.	
	100·2	

The excess arises from an absorption of oxygen by the protoxide. The analysis is subject to revision, if time permits, in this particular; but the result in pure iron cannot be materially changed. This specimen is apparently ten or twenty per cent. below the richest pieces brought from the range, and is above some of the poorer slaty specimens.

For present use, a supply of ore may be obtained from the rubbish at the foot of the uplifts, in blocks and pieces already detached from the cliff and the accompanying quartz. Where it is not dislodged, it will be necessary to break the whole, and then assort it. There are cases where numerous particles of the oxide is disseminated through the quartz rock, above and below the regular beds. This might be separated by bruising and stamping—a process which the whole must undergo in order to be profitably wrought in the forges.

There is no limestone yet known in the region to be used as a flux; but there is an abundance of timber and water-power.

There are certain proportions of iron and silex, and of silex and magnesia, that are easily fused. If the silex of this ore is not so excessive as to make it refractory, or if, in practice, that difficulty can be remedied by the use of magnesian slates, which are abundant, these mines may be wrought hereafter at a profit, and rival the works of Northern Europe.

The magnetic ores of the northern part of the State of New York, that have produced iron famous for its strength, are also siliceous. The magnetic iron ore is freed of a portion of its silex, at little expense, after being bruised, by the application of magnets, acting on a large scale upon the magnetic particles. The part which enters chemically into the ore, forming a silicate, is not wholly cleared by working, but gives a very fine-grained metal that is peculiarly good for steel.

The famous Swedish iron is from beds of magnetic ore, embraced in hornblende rocks, doubtless metamorphic, and analogous to the Bad River rocks. The extensive mines, or rather mountains of iron ore, in Michigan, described by Houghton, Burt, Jackson, Foster, and Whitney, are also magnetic, and associated with metamorphic slates. These ores are, in some cases, more inclined to the peroxide than the Bad River beds; but specimens from the two regions are often so similar, that no one would be able to separate them by the texture, color, or weight. The geological associations are precisely alike. In Michigan, as in Wisconsin, the mountains composed of tilted magnesian, hornblende, and siliceous slates, inclose beds of ore.

There, as here, on each side of the metamorphic range, are igneous rocks, of various ages and composition—quartzose, granitic, syenitic, and trappous. The ores of that region have attracted attention, and one establishment for making blooms direct from the ore has been in operation more than a year—(1852). The iron is remarkable for its solidity and toughness, keeping its place better than Swedish, and no more brittle. It possesses the quality of being worked into fine cold-drawn wire, and has been sought after by an establishment for manufacturing wire in Massachusetts.

The blooms brought from Lake Superior to the Pittsburg market are, however, represented as being inclined to "red short," that is, liable to crack under the roller or hammer, at about a red heat.

The position of the best exposures of ore which Colonel Whittlesey saw, was such as to require from eighteen to twenty-eight miles of transportation to reach the lake. The nearest natural harbor is in Chegwomeginn Bay, about twenty-five miles from the central part of the Kenokie range. At Montreal River, which is the nearest part of the coast, and from its mouth to the mouth of Bad River, there is no place where an artificial harbor can be made. At Bad River there will be a good harbor, when the sand-bar at the mouth is removed, and kept clear by the construction of piers.—*Condensed from Dr. Owen's Survey of Wisconsin, by Dr. L. Turnbull.*

AMERICAN IRON FOR RAILROADS.

The importance of the manufacture of iron for railroad purposes is hardly appreciated in this country. The enormous demand which is destined to exist, with a uniformity and ability of which we at present see but little, is sure, if properly supplied at home, to produce a wonderful effect on the manufacture of iron. On the subject of car wheels we find some interesting remarks by Mr. J. L. Gage of St. Louis, relative to the adaptedness of Iron Mountain pig, which we here insert:—

The innumerable deposits of iron ore in the United States furnish as great a diversity, and as good a quality, of that material as can be found in the world. Yet in malleable iron we make nothing like the Swedes; while in pig, we make nothing, with either our bituminous or our anthracite coal, equal to the Scotch. Our Juniata malleable iron is as strong as the Swedes; but being softer, will not wear half as long, in either a horse-shoe or a log-chain. The Tennessee iron is as good as the Juniata, and the Iron Mountain equal to either, though differing from both. For foundry purposes, there is no better pig than that made in southern Ohio, and northern Kentucky—the coal blast iron, for machinery—the hot-blast, for stoves and hollow-ware. I greatly doubt whether any hot-blast pig can be found equal in strength and excellence to that of southern Ohio. But the supply for the last two years has fallen far short of the demand. This demand has made a market for millions of dollars worth of Scotch and English pig, and rails, that ought to have been made in this country. So great has been the call, that the capacity of those countries to produce them has proved unequal to the demand. This state of the iron market is the legitimate result of the new railroad and gold developments. The railroads diverted thousands of hands from agricultural, and other industrial callings, and these roads created the unusual demand for iron; hence it became scarce and dear. Tens of thousands flocked to the land of gold, and gold became abundant and cheap. But, measured either by gold or by labor, iron has found a proportional value. It is worth more—it represents more labor, and demands, as an equivalent of exchange, more gold.

The relative change has caused the springing up of innumerable new furnaces in our own country, induced by the laudable attempts now making in various parts of the United States to manufacture iron from the ore, with

bituminous, cannel and anthracite coal, and established new rolling mills to make rails for the various roads progressing in the United States. The Wisconsin ores, equal to any in the world, are yet undeveloped. The Missouri mines are in process of being worked. They present a great variety of ores, and have required a largely diversified series of experiments to make them available. But they are now worked, and will soon be extensively used.

The Pilot Knob makes a very good hot-blast iron for stoves. The Mountain worked with cold blast is a very different article. It will not make stoves or hollow ware. Its great proclivity to chill or to become carbonized, renders it unfit for light machinery, but when rightly mixed with other iron, it is the best iron for car-wheels in the world. There is no stronger iron—none that is soft and strong that so readily chills, and hence none so well adapted to making wheels.

In making a car wheel, two things are indispensable—great strength and a hard "tread," or periphery. It must be strong, for a weak wheel endangers human life. It must have a hard tread, or it immediately wears out. This is easily proved. A brake is placed on each wheel of every car, and when the engineer sounds his alarm, the brakes are frequently put down so hard that the wheel slides on the rail. The point of contact between the wheel and the rail is but a point. The weight of a passenger car is nearly seven tons; with thirty-five passengers it will be about nine tons, or over a ton to each wheel. The sliding of a wheel 20 or 30 rods with such a weight upon it, will soon wear the flat place on the "tread" unless it is very hard, and when once it begins to wear it soon becomes ruined; inasmuch as this flat place is the stopping point when the brake is applied. In making the double plate wheel with the solid hub, the plates crack in cooling. To obviate this difficulty, the manufacturer anneals his wheels; but if the wheel is made of Iron Mountain pig, it may be thrown out of the moulds as ordinary castings are, without breaking. Hence, as soon as the excellence of this iron for making wheels is known, it will be eagerly sought after, and all that is made will be used for that purpose. I speak here of the charcoal iron. Whether a good iron can be made from any of the Missouri ores, with bituminous, cannel or hard coal, or coke, remains to be tested. In its solution Missouri has a great and an untold interest, the importance of which few have fully considered.

IRON MANUFACTURES OF CLEVELAND, OHIO.

One of the public papers of Cleveland gives us a glimpse of what is in progress there relative to the manufacture of iron:—

Some of the principal establishments in the manufacture at present, in Cleveland, are the Lake Erie Iron Works of Ford and Otis, situated on the Lake shore, west of Cleveland, which have been engaged for upwards of a year in the manufacture of axles, engine frames, shafts, steamboat and other description of forging. Some of these have been produced from Lake Superior blooms. The present works, occupying a main building of 250×60 feet, and employing four of Lewis Kirk's large steam hammers, are capable of turning out 2,500 tons of finished forgings per annum. Large quantities of axles are sent to Chicago and Canada.

The Cuyahoga Steam Furnace Company, mainly in the control of Mr. E. B. Sterling, have erected a commodious new shop, with a beautiful condensing steam-engine, and heavy and accurate tools of their own construction, and are now completing a very good, although a cheap style of locomotive, at the rate of two a month. The Cleveland, Columbus and Cincinnati, and Cleveland and Erie roads, have received more than half of their stock of motive power from this establishment, and their officers express themselves highly pleased with all the work from the Cuyahoga Works. To Mr. Rogers, foreman of the Cuyahoga works, are attributed many improvements in locomotives, generally adopted at the present time by locomotive builders at the east. We believe

he applied the first graduated, variable, independent, cut-off valve in the country.

The former shops of the Cuyahoga company are still carried on in connection with the new works. The condensing engine at the new shop, with a cylinder sixteen by twenty-four inches, consumes 900 lbs. of the Tallmadge coal per day, costing about $1. At the time we saw this engine it was working under a vacuum, or without steam, for by opening a cock directly into the cylinder or steam chest, no steam could escape, but air would be drawn in with great force. While working in this way, it was driving a considerable amount of shafting and machinery, all in fact that had been placed in the shop.

G. W. Sizer & Co. have one of their foundries here. They have another at Cincinnati, and one at Chicago. In their Cleveland foundry they are casting large numbers of chilled car wheels, and cast iron chilled engine tires, besides frogs, chairs, car works, etc. There is also a wheel foundry, we believe, in connection with Watson's car factory, located east of the Cleveland and Pittsburg railroad shops.

William S. Craig, J. Franklin & Co., and McLelland & Co., have foundries and shops also in operation.

The railroad shops are among the most important establishments of similar character in the Forest City.

From the same quarter we have the following respecting the introduction of Renton's process at the Forest City Iron Works:

After encountering a series of difficulties, incident to all new projects, the new principle was put to a final test last Saturday afternoon, and the result was a complete vindication of the sagacity of the projectors and of the skill of Mr. Renton. We had the pleasure of being present during the trial. In a period of three hours, six blooms, varying in weight from 60 to 161 pounds, were run off. Within five hours, 1,188 pounds were run off, averaging per hour during the first three hours, 227 pounds, and during the last two hours, 303 pounds. There will be no difficulty in running off three tons of blooms per day, from each furnace, and as the present works will contain twelve furnaces, the product each day will be about forty tons.

The new process is extremely simple to any one acquainted with the qualities of iron. The portion of ore usually called dross, is more easily melted than the iron; and this fact probably suggested the idea of the new process to Mr. Renton. By reducing the ore to about the consistency of coarse sand, and subjecting it to a heat sufficient to cause the particles of iron to cement, the dross is melted, and thus separated from the iron which is taken out in masses, called balls, and beaten into blooms. The hammer weighs nearly 10,000 pounds, and the ore crusher possesses such vast power that fifteen tons can be crushed in sixty minutes.

Several scientific gentlemen were present during the trial, among them Mr. Foljambe, Mr. Renton, Mr. Houston, who is erecting iron works on the same principle.

TEMPERING AND GRINDING STEEL, ETC.

Mr. Chesterman, of Sheffield, England, has lately invented and patented several valuable improvements in hardening and tempering steel, and in grinding, glazing, buffing, and brushing steel and other metallic articles. The process of hardening and tempering apply principally to thin steel, such as are used for saw blades, for example. The hardening is effected in the following manner: The inventor takes a strip, say from ten to thirty feet long, and winds it into a circular cast-iron case of about the same depth as the width of the steel. In the side of the case is a gate or aperture, through which a small portion of the outer coil of the steel is made to protrude. He then puts a cast metal lid on the top of the case, so as to cover the whole of the steel, and

places the case in the furnace, and allows it to get red hot, when it is removed by one workman, while another seizes hold of the protruding end of the steel, and draws it through a pair of cold steel, metal, or stone dies or plates, by which the steel will be hardened, coming out flat. The dies or plates are to be kept cold by having cold water applied to them, or they may be made hollow, and a stream of water be caused to flow through them. Shorter and stronger lengths, such as steel saw-blades, etc., are hardened by placing them in a furnace and allowing them to get red hot, and then quickly introducing them and subjecting them to pressure between two dies or plates, mounted in a frame so as to form a press, by which means they are both hardened and prevented from warping or buckling—care being again taken to keep the dies or plates, whether of metal or stone, cold, by the application of water. He tempers these articles in the ordinary manner, and the tapes or strips as follows:—After the strip or length of steel has passed through the dies or plates, it is removed to a stretching-table, where one end is made fast between screw-clamps or otherwise, while the other end is clipped between another pair of screw-clamps attached to a leather strap, which is fastened to a drum or roller turning in bearings, and furnished with a lever or arm, which is weighted so as to produce a gentle strain on the steel. The steel is then oiled or greased, and heat is applied to it from a portable furnace or gas light attached to a flexible tube, or from any other source, so as to blaze off the oil or grease, whereby a fine spring temper will be imparted to the article operated on, and it will be left flat and straight. Or a fixed gas furnace is employed, and the steel drawn from the hardening dies or plates direct through the gas furnace, thus becoming hardened and tempered at one continuous operation.

For the purpose of grinding both sides of a flat article, or the entire periphery of a circular or similarly shaped article, the inventor fixes upon a central tube or axis, a grindstone in the form of a roller or cylinder, and makes this stone plain or indented with semicircular or other grooves, according to the shape of the article to be ground; and over this grindstone roller he mounted another similar to it. Upon rotary motion being imparted to the rollers, and the end of the article to be ground being inserted between them, they will draw it through, but without grinding it; the article is then to be drawn or pushed by the workman in a contrary direction to the rotation of the rollers, and the grinding will then take place in its passage between them. The sides of one of the rollers, when the articles to be ground are flat, are also provided with collars formed of grindstone, and of a larger diameter than that of the rollers, whereby the edges, as well as the sides of the metal article, may be ground, when requisite, at the same operation. Means are provided for adjusting these rollers to suit the thickness of the articles to be ground, and also for adjusting the stones on the central tube or axis. For the purpose of grinding one side only of a steel or metal article at a time, a plain wooden roller is substituted for one of the grindstone rollers; and combined with this arrangement are guide-rollers for cross-grinding.

These improvements in grinding will be found of especial advantage in the case of saw grinders, who, as a body, are subject to severe diseases of the chest and lungs, called the "Grinder's Complaint," caused by standing or sitting over the stone. To such an extent is this complaint prevalent, that it is no uncommon thing for persons thus employed to become incapacitated from following their occupation at a comparatively early age. By the present improvements this evil will be in a great measure obviated, as the men will be enabled to grind articles at a considerable distance from the stone, and in front of it, instead of leaning over it, as is the common practice. Another important consideration is, that in the event of grindstones flying to pieces—by no means an uncommon occurrence—the men will be much less likely to be injured, or perhaps killed, while standing at a distance from the stone, than if they were over it, as they would be under the ordinary system.—*Scientific American.*

STANNO-PLUMBATED IRON.

Several important experiments on the preservation of iron from oxidation and decay having been made by the Rev. N. Callan, of Maynooth College, who has introduced many improvements in practical science, he has found that an alloy of tin and lead, or of tin, lead, zinc, and antimony, is the most effectual. He recommends that the alloy should contain at least as much lead as tin, but not more than 7 or 8 parts of lead to one of tin, the iron being treated with this composition just as it is usually coated with tin. In a series of experiments on the decomposition of water by the galvanic battery, the patentee found that concentrated nitric acid acted far more powerfully on lead than on iron coated with an alloy of lead and tin. He afterwards made experiments, comparing the action of strong nitric, sulphuric, and muriatic acids, on lead and galvanized iron, and iron coated with the new alloy, and found that the latter was far less oxidizable than lead, and very far less than iron galvanized, the zinc coating of which is rapidly dissolved, even by very dilute acids; hence, iron coated with this alloy will answer all the purposes for which sheet lead, lead pipes, or zinced iron are employed. The addition of a small portion of zinc hardens the coat, but diminishes the power to resist corrosion; while a little antimony hardens it, and increases its anti-corrosive powers. Stanno-plumbated iron will answer better for wire-rope than iron coated with zinc, as it will resist the action of sea-water better. It is preferable to lead, as cheaper, more durable, and less subject to changes from variations of temperature; and it may be used for all the purposes for which galvanized iron is employed; it is more easily worked and soldered. It may be used instead of copper for sheathing ships, and bolts and nails of cast-iron may be employed. As the proportion of tin need not be more than the seventh or eighth of lead, the alloy will be very little dearer than zinc, and from the greater durability, stanno-plumbated iron must be quite as economical as galvanized iron.

GALVANIZED IRON.

The preservation of iron from oxidation or rust, for a series of years engaged the attention and taxed the ingenuity of practical and scientific minds, and a variety of processes had been suggested and tried without producing satisfactory results, as none were found to stand a test of time when exposed at the same time to the destructive influence of atmospheric changes. The researches of Sir Humphrey Davy, in 1824, at length threw a new light on this important subject, and the concurrent testimony of Brande and Faraday, of England, and Professors Morse and Henry, of our own country, backed by the acquired practical experience of thousands of consumers, have long since established the fact that iron prepared by what Davy termed the "galvanizing" process, is entitled to take precedence of all other metals, for the several uses to which it may be applied. The French Marine Commission have recommended its use in the French Navy, and J. W. P. Lewis, Esq., an accomplished engineer of Philadelphia, who speaks from actual observation, and careful notice of the results of several experiments made on galvanized iron, fully coincides in the views taken by Brande and others, that iron, when galvanized, is fully protected against rust, and we hope ere long to see it universally adopted in every section of the country.

The principal establishment at present engaged in its manufacture is that of McCullough & Co., who, in 1847, erected works on an extensive scale, at North East, Cecil county, Md., on the line of the Philadelphia, Wilmington, and Baltimore Railroad, for the manufacture of all kinds of sheet and flue iron. They have also just completed an extensive rolling mill in the same county, on the Big Elk Creek, about two miles from Elkton, Md., operated by water-power, with a fall of over 20 feet. The fly wheel of this mill is over 20 feet in diameter, weighs 40,000 pounds, and is capable of making 90 revolutions per minute. The rolls are 36 inches in length and 24 in diameter, and are calculated expressly for the manufacture of the galvanized sheet iron, for

which purpose these new works were designed. The sheets are rolled from the best charcoal blooms, and have been found far superior to the English make, as they will work into many articles for which the foreign will not answer, being too brittle and not suitable for flanging or seaming, as practised in metal roofing, being liable to crack or break by that process, and consequently making the roof imperfect; whereas the iron from McCullough & Co.'s is so malleable as to entirely obviate that objection. It is seamed on in the same way as tin, and is now being very generally used in place of the latter, being cheaper and more permanent. The foundry of Mr. Huston, as well as many others in this locality, and the Farmers' and Mechanics' Bank in Chestnut street, Philadelphia, are roofed with corrugated sheets of this material, which for beauty and durability cannot be excelled. The iron is first rolled at the works, and then sent to their establishment in Wilmington, where it is galvanized and prepared for the market.

GLASS ENAMELLED WROUGHT IRON WARE.

We have on several occasions noticed improved methods of coating iron with glass, or enamel, for the fabrication of domestic utensils, combining all the properties of porcelain or other earthen ware, with greater strength and durability; and among these is one patented by Mr. Paris, producing articles of a very superior description, the sole agents for the sale of which are Messrs. Robinson, Langton, and Company, Talbot-court, Gracechurch-street. It will be remembered that in the earlier periods of the manufacture of glazed iron ware, the enamel was of an opaque white, for the securing a proper consistency to which, and to cause an intimate and adhesive contact with the metal, the white oxide of arsenic was largely employed, which, on the composition becoming decomposed by heat and wear, was exceedingly dangerous to human life, and at all times deleterious to health. The material under notice is covered either with a pure transparent colorless glass, or colored in any design, without the slightest admixture of any deleterious ingredients. They are made from sheet-iron of various thicknesses, according to the article to which the manufacture is applied, combining great durability with wholesome cleanliness and elegant appearance. They will stand any amount of heat, and are as readily cleaned as china, crockery, and glass, and can be thrown about or dropped from any height without fear of breakage, and their adaptation to ships' use and for emigrants is thus obvious. Some of the first constructed articles of this description were heavy, and of clumsy, cumbersome appearance, but these being made of sheet-iron are pressed at once into form, and the smaller articles, such as cups and saucers, dinner plates, drinking mugs, candlesticks, &c., have a light and elegant appearance. The principal articles comprise saucepans, kettles, stewpans, preserving pans, frying pans, baking and meat dishes, wash basins, bowls, pails, buckets, color, brewing, and laundry boilers, poultry fountains and troughs, gas tubing, &c., and a complete service may be obtained, which will last through the wear and tear of many voyages, or on land for a number of years. Their economy and cleanliness are remarkable.—*London Mining Journal.*

IMPROVEMENTS IN IRON MANUFACTURE.

A patent has been taken out by Mr. J. H. Johnson, of Lincoln's Inn-fields, for a peculiar process in manufacturing iron. It consists in the formation of a series of deoxidizing tables, on which the iron ore, after being roasted, pulverized fine, and of even grain, is placed. It is then exposed to the heat of the waste gases from the refining hearth, and to additional heat from furnaces placed beneath the tables.

COATING IRON WITH BRASS OR COPPER.

Hugh Burgess, of Kentish Town, England. Patented in England, February

17, 1853: I desire to state that I do not claim any of the apparatus, or the process to which they refer.

I claim the coating of iron sheets, bars, bolts, and other forms of iron, with copper or brass, by a combination of processes, as follows: by first cleaning, then coating them over with a solution of cadmium or zinc, drying and dipping them into a bath of melted copper or brass, and raising them out of the bath into an atmosphere of steam and carbonic acid, flowing in streams or in jets, as described.

FURNACES.

Mr. R. W. Jearrad, of Upper Eccleston-place, has patented an invention, the object of which is to prevent the emission of smoke from furnaces. For this purpose, the interior of the furnace is made of such a height above the fire-bars as to admit of the introduction of a horizontal partition of fire-brick, tile, or other materials, which proceeds from side to side, and from the front nearly to the back of the furnace. This partition is perforated with numerous holes, through which part of the products from the fire pass, whilst others pass through the space at the open end; above there is a second perforated partition of fire-brick or tile, fixed at the back, and proceeding nearly to the furnace front; the products from the fire pass under and then over this partition, and then away to the flue, which passes through the boiler at a lower level than that at which the heat and products leave the fire-box.

THE BLACK-BAND ORE.

The statements we made last week in relation to the discoveries in the George's Creek Valley of iron ore of the quality called "black band," were correct. Very extensive veins have been traced, varying in thickness from twenty-two inches to three feet. The ore has been carefully analyzed by one of the most distinguished chemists of the State, who pronounces it of a superior quality. It has, moreover, been converted into iron at the Lonaconing furnace, and found to be all it was represented. That furnace is now in full blast, and will use large quantities of the "black band." The ore is of the color of slate, which it very much resembles. It is mined at a cost of only $3 per ton. The discovery is consequently a most important one.—*Cumberland Journal.*

THE COLLINS IRON COMPANY.

During the last fall, a new Company was formed for the purpose of converting the ore of Lake Superior into iron. The Company organized under the style of "The Collins Iron Company," with a capital of $500,000. Elon Farnsworth, Esq., of Detroit, is President, and C. A. Trowbridge, Esq., is Secretary. The Company have a location of over five thousand acres, including an iron mountain and extensive water power in Marquette county. It will proceed at once to work the mine, and manufacture iron.

QUARRIES AND CLAYS.

KAOLIN IN NEW JERSEY.

About a year and a half since, some persons in searching at West Milford, Passaic county, for iron, came across a bed of clay, with the nature of which they were unacquainted. Until recently it has not been improved, on account of ignorance of its value; but a scientific investigation has revealed the fact that it is kaolin, an exceedingly valuable porcelain clay, which is quite

scarce. It can be used in the manufacture of porcelain wares, tiles, fire-brick, the glazing of cards, soap, paint, &c. The deposit at West Milford is of the purest kind: it is of various colors, white, red, chocolate, and others.

The porcelain manufactured from it will be equal, it is thought, to the best French. The deposit is large, and a company of capitalists is about to be formed, under the name of "Mackapin Kaolin Company," to work it. Similar deposits exist in Japan, China, Saxony, France, England, one at Amboy, discovered by the former geological survey, and one of an inferior kind near Philadelphia. The composition of the clay is alumina and silica, and it is generally formed from disintegrated granite. Many gratifying results, similar to this, will certainly be accomplished by a thorough exploration of the resources of our State.—*Newark Advertiser.*

COMPOSITION CASTINGS.

It has long been a desideratum in the adaptation of fine art to the refined wants of daily life, as well as for purposes of science, that works of sculpture should be capable of being produced at a cheap rate. Many processes have been tried to render plaster solid; but none has hitherto proved in every respect successful, the requisite degree of transparency not having been obtained. Dr. Emil Braun has at length succeeded, we are told, in the production of a material adapted to plastic purposes, which affords the same sharpness of outlines as plaster of Paris, is scarcely inferior in whiteness to the finest statuary marble, and even surpasses it in impermeability of surface, being perfectly impervious to wet, and capable of resisting all inclemencies of weather.

The inventor has already exhibited several busts and statues of this composition, which have been viewed by the sculptors and artists of Rome, who are unanimous in their opinion as to the beauty and value of the material, the fracture of which even presents a crystallized structure. This material is well adapted for the most delicate objects as for works of colossal size; the former exhibiting the utmost refinement of execution, whilst the latter proves that it is capable of resisting any degree of weight arising from the bulk of the objects themselves. In this material fac-similes of the most beautiful monuments of ancient or modern times, architectural ornaments, &c., may be reproduced at a price not greatly exceeding that of plaster casts. Thus not only houses and museums, but also gardens and parks, and all open court-yards or spaces destined for decorative purposes, may be adorned with the finest works of sculpture which the world affords.

IMPROVED STONE DRESSING.

Charles T. Porter, of New York, has applied for a patent for improvement in machinery for dressing stone, whereby some advantages are promised to those engaged in this extensive and constantly increasing business. In a late invention the adjustment of the ways at the desired angles, and the maintenance of the proper relations between the rest, the hammer, and the toolstock, are provided for by the employment of a cylindrical rest, and further by giving a concavity to the toolstock whereby it is fitted to the cylinder, and pivoting the ways to the rest. Mr. Porter professes to have rendered this cylindrical arrangement unnecessary, thereby simplifying the desired process and lessening the cost of machinery, and to have attained other desirable ends. Among these he specifies the accomplishment of a more rigid connection between the ways and the rest, whereby much racking and disarrangement is obviated. The rest and ways, which constitute a sort of frame, are furnished with journals fitting to suitable boxes in the main framing, and these journals serve as pivots upon which the rests and the ways swing together in such a manner as allows of their adjustment as the altered motion of the hammer requires, from time to time, in order to secure the desired angle *of cut or dressing.—Scientific American.*

NEW YORK AND CONCORD GRANITE COMPANY.

The Report of this Company, which is now in operation, for quarrying granite at Concord, in New Hampshire, contains some important and valuable particulars, which we subjoin:—

The New York and Concord Granite Company was organized in March, 1854, under the general law of the State of New York, in relation to the formation of corporations for manufacturing, mechanical and other purposes, with a capital of 100,000 shares of five dollars each, to be managed by five trustees, under a reserved working fund of 20,000 shares.

The real estate belonging to this Company, which is wholly paid for and entirely unincumbered, is situated at Concord, New Hampshire, and consists of about seventy-seven acres of land, including the granite quarry known as the "New Hampshire Ledge."

The Company have also, in addition to other personal property, secured, and paid for, the exclusive right to use the machines of the American Stone Dressing Company in Merrimack county, which the Trustees consider of great value, being the only machines, with which they are acquainted, that can successfully dress granite.

The Trustees do not consider it wise to herald the prospects of the Company, or enlarge upon the value of its property, so long as they can refer to well established historical facts, sustained by the sober testimony of time, to speak for them.

The following extract from "Hayward's New England Gazetteer," coming to them, as it does, free from the bias of interest or dreamy speculation, and under the responsibility of the historian, is entitled, the Trustees think, to that consideration and weight which patient and laborious investigation usually ensure.

"This Ledge is situated about one and a half miles N. W. of the State House, and about 200 rods distant from Merrimack river. The course of the Ledge is from N. E. to S. W., and its rise about 45° from a plane of the horizon, and its height about 350 feet. It presents a surface of massive primitive granite, of more than 4,500 square rods. The rift of this stone is very perfect, smooth and regular; splits are easily made to the depth of 12 to 20 feet, and of almost any required length. And unlike much of the building stone now in the market, it has been ascertained by a recent examination (made by A. A. Hayes, of Roxbury, Mass., and other eminent chemists and geologists,) that the stone from this quarry is perfectly free from those oxides, or other mineral substances, which on exposure to the atmosphere mar the beauty of much of the New England granite. This stone quarries easily, the great elevation and dip of the ledge, and its proximity to the river, giving it facilities of working and transportation, it is believed, unequalled. As the great facility of transportation to the markets becomes known, together with the fact, that the upward freight would, during a great portion of the year, go far towards remunerating the cost of transportation of this stone to the seaboard—the situation, extent, and value of this quarry will be seen and appreciated. On several large perpendicular faces of the ledge, protected by shelving rocks from vegetable stains, but exposed for ages, perhaps, to the atmosphere, the stone is found to be entirely free from any coloring or stain, preserving its natural color. The amount of the whole mass, when wrought, can scarcely be estimated."

The Company is now engaged with a strong force in laying open the Ledge to the greatest advantage—the cash means for that purpose, and for the extensive working of the quarry, having been provided.

The experience of the past enables the Trustees to state that the stone can be quarried and dressed for about one-fourth less than the Quincy stone; and as the material is generally admitted to surpass in strength, durability, and beauty, any other stone offered for building purposes, it is confidently believed

that the demand for it, as large as it now is, can be increased to an almost unlimited extent.

THE BURNETT STONE QUARRY.

The Burnett Stone Quarry is composed of a beautiful light sky-blue-colored stone, remarkably hard and fine-grained. It is situated on the banks of the Ohio River, one hundred miles above Cincinnati. Mr. John Clowes, C. E., of New York, who has made an examination of the quarry, thus describes it:—

Situated at a place known as "Warring's Landing," on the bank of the Ohio River, in Lewis county, State of Kentucky, about one hundred (100) miles above Cincinnati.

The Company's real estate, connected with other lands in which they have secured the privilege of quarrying stone, embraces an area of about one hundred and twenty-five (125) acres, contains all the stone of this quality and color yet known to exist.

The stone differs from any other building-stone found in any part of America, being of a beautiful light sky-blue color, composed of a fine, hard grit sand-stone; its texture is so hard and finely grained, as to render it an excellent material for sculpture in every department of ornamental work.

The front line of this stone is about forty (40) rods back from the river, and such is the formation of the land as to admit very extensive operations, without any additional expense for roads or drainage, and when worked to the best advantage, requires neither railroad nor crane; no matter how large the stone, in weight or length, the same may be taken out of the quarry and loaded into the boats without any machinery, except that of the most simple character. The landings are good at each creek, the shore bold, and water deep at low water-mark.

The yearly income from this stone quarry depends altogether upon the quantity taken out. If a working capital sufficient to carry on the concern, and deliver the stone in Cincinnati, was invested under a judicious management, it might be made to yield a yearly profit equal to half the investment, if not more.

The difference between the expense to deliver, and the price obtained, on large contracts, is as 4 to 7, securing at least a profit of seventy-five per cent. It is a well-established fact, that it will not exceed twenty cents per cubic foot, all expenses included, to deliver it in Cincinnati in the rough, to order; and the least price received for large contracts is thirty-five cents per cubic foot, and for many small orders, for columns and other extra stone, the price received is from fifty to sixty cents per cubic foot, without any additional expense to quarry the same.

This stone is extensively known and highly appreciated in the Western market. Many thousand cubic feet have been sent from this quarry to Cincinnati, Louisville, New Orleans, and other places. The steps and columns of the Burnett House were taken from this quarry; also the fronts of some of the most admired and elegant houses in the western country, were from this place; and at the present time, this Company are offered a contract for 150,000 cubic feet of stone, to be quarried to order, for the new Court House in Cincinnati, at 35 cents per cubic foot in the rough. They have also applications for stone, on the same terms, from Indiana, Kentucky, New Orleans, and other places, to erect State Capitols, City Halls, Court Houses, Churches, and other public and private buildings. The price and quality of this stone will insure to the Company a permanent preference, providing the orders were executed at the time stipulated.

MISCELLANIES.

SULPHUR.

The King of Naples, as our readers are no doubt aware, has published a decree, prohibiting the exportation of sulphur from Sicily as "contraband of war," the excuse being that, according to the law of nations, and to avoid collision with either of the belligerent powers, he is compelled thus to act, in order to preserve the strict neutrality which he has laid down for the kingdom of the Two Sicilies. This, no doubt, is correct in the abstract, but as about 100,000 tons are annually exported from the Island of Sicily, there can be but little difference of opinion that the prohibition will be felt most severely by his own subjects; at the same time, it will be productive of great injury to several of the manufacturing interests of Great Britain and France, as out of the produce exported, this country took more than two-thirds annually, and so great has the consumption increased, that although in 1820 it was only 5,000 tons, yet in 1848 it had reached 46,000 tons, and has since been gradually augmenting. If sulphur alone entered into the composition of gunpowder, the inconvenience would not so seriously be felt, but as it is employed for several more useful purposes, the want of it, unless some substitute is found, will be productive of great inconvenience. Among the uses to which it is applied is the manufacture of sulphuric acid and vermillion. Sulphurous acid, formed by the combustion of sulphur in the atmosphere, is employed to bleach linen and woollen goods, as well as cotton stockings; it is likewise used to disinfect vitiated air, though inferior in power to nitric acid and chlorine; to kill mites, moths, and other destructive animals in zoological collections; cementing iron bars in stone. In the arts it is used in taking impressions from seals and cameos, for which purpose it is kept previously melted for some time, to give the casts the appearance of bronze. Its medicinal qualities are well known, and the manufacture of that simple article of domestic comfort, lucifer matches, has become a flourishing trade.

As it is impossible to calculate the duration of the present struggle, or speculate on the period at which the termination of the prohibition will take place, it behoves us then to see where an efficient substitute can be found to fill up the hiatus that has thus arisen. The great superiority of volcanic sulphur over all others is, that it is free from the impurities of arsenic, and other semi-metals, which in general are intermixed with that obtained from pyritical ores; but we should imagine, with the extended knowledge of chemistry which several of our most eminent men in that science possess, that this difficulty might be obviated. Sulphur at a cheap rate, and by a simple process, has been extracted from the ores at the Parys Mine, in Anglesea. The same is now done in several of the mines at Clausthal and Goslar. Why should not the experiment be tried on a large scale in Cornwall? There are qualities of poor copper ores which scarcely pay the expense of dressing, and are rich in mundic. If these were properly manipulated, both the copper and the sulphur might be made to pay.

When we consider that over 60,000 tons of volcanic sulphur are used in England, and about 20,000 in France, and if a mineral approximating to that could be manufactured, it will be seen that there is no fear of a market being found at a remunerative profit for any quantity that could be raised. At present, the greatest portion of this useful mineral is thrown away: such was the case with the first copper ore discovered, which was cast aside as *podder*, and now is the principal and staple product of the county of Cornwall.—*London Mining Journal.*

THE ALKALI TRADE.

The manufacture of alkali has become a most important branch of industry

on the banks of the Tyne, and there are several large firms engaged in its manufacture upon this river, under whom many hundred men find employment. In consequence of the present state of Europe, it seems that the manufacturers in Germany and the other countries receiving their supply of soda from England through the Baltic ports, are in a very depressed condition, and in consequence of this state of affairs the price of soda is fallen 20 per cent. on the Tyne since the declaration of war, and most of the large houses have heavy stocks in their warehouses. The prices of soda have also fallen in New York, the *entrepot* of soda of English manufacture with the Western hemisphere. Some time before the declaration of war a Tyne house entered into a contract to make a large quantity of bleaching powder for St. Petersburg. In the present state of things the contract cannot be completed.

LAKE SUPERIOR MINING NEWS.

Mr. John W. Bradford, formerly connected with the editorial department of one of the dailies of this city, and of much experience and talent as an editor, has undertaken the publication of a journal in the Ontonagon Region. We doubt not that it will be a good paper. The following is the prospectus entire. Terms, Three Dollars per annum.

It is proposed, if sufficient support and patronage shall be secured, to publish, at Ontonagon, a newspaper, semi-weekly in the summer months, and semi-monthly during the remainder of the year, upon the departure of the mails. It shall be devoted—

To the News of the Day—

To the Development of the Mining Interests of the Lake Superior Country—

To Scientific and General Intelligence relating to those Interests—

To giving Accurate and Thorough Reports of the condition of all the mines and mining stocks of this section of the country, and also of the sales here, and in the principal cities of the United States, so that each may find correct and reliable reports of the market in other places—

To advocating all subjects that shall advance and promote the improvement and growth of this section of country, and a more immediate and speedy communication with other parts of the country by Water, Railroads, and Telegraphs.

We shall commence in an early number, a complete and minute History of the Discovery, Exploration, Settlement, and Mineral Development of the North-western country, and more particularly of the Lake Superior Region, the materials for which we have been for some time collecting.

An Express will be established between this place and the Lower Lakes, by which we shall be enabled to transmit and receive the Earliest Intelligence.

We shall make personal explorations of all the mines and mineral lands here, and give impartial reports upon them at the earliest opportunity, so that we shall be able to furnish the most reliable news of their progress.

We have not undertaken this enterprise without an anxious appreciation of the responsibilities and labor involved in the performance of our duties, and we are resolved that integrity and impartiality shall be maintained in all we publish; and for the success of our enterprise we must depend, next to our own exertions, upon the patronage of the public; should that be at all adequate, as we firmly hope, we shall gratefully labor to fulfil our duties, and continually add to the value of our paper as we are able.

THE MINING CHRONICLE,

Published weekly in this city, by M. B. Monck & Co., is a diligent and laborious co-operator in the field of mining intelligence, formerly conducted as the "*Iron Manufacturers' Journal.*" It is prepared with skill and care, and is always interesting.

THE

MINING MAGAZINE.

EDITED AND CONDUCTED BY

WILLIAM J. TENNEY.

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VOL. III.—OCTOBER, 1854.—No. IV.

ART. I.—THE PROPERTY OF THE PRIDEVALE IRON COMPANY.—REPORT OF PROF. WILLIAM B. ROGERS, STATE GEOLOGIST OF VIRGINIA.

THE following report of the mining resources of the Pridevale Iron Company will be found more detailed and specific than was contemplated when the geological examination of the property was first proposed. This has arisen from the variety and minuteness of the observations which I have found it necessary to make. Had I met with a seam of ore of the great thickness and extent which rumor so often vaguely ascribes to these deposits, I could, in a short time, have made all the examinations necessary, to assure the Company of a solid foundation for enterprise, and to guide in the mining operations which would be required. But in the Pridevale tract, as in the coal regions of Virginia and Pennsylvania generally, the seams of iron ore are not large, and are fluctuating. I have, therefore, felt it to be vital to the interests of the Company, that I should examine every layer of ore on or near the Company's land, in order to learn, in the first place, whether from these multiplied sources, notwithstanding the absence of any large deposit, an adequate supply of ore could be anticipated; and, in the second place, by a comparison of their character, thickness and continuity, to form a safe judgment as to which beds are the most desirable for use, and the most to be relied on for permanency.

With these views I have visited every opening of importance within the limits of the property, as well as many in the neighborhood, and I have included in my examinations the coal seams and beds of fire-clay and limestone of each locality. The result of this extensive exploration has been the conviction that the Anna, Henry Clay and Woodgrove furnaces can each command an adequate supply of ores of various composition and richness, and that by a judicious mining of the better varieties, the products of the furnace and rolling-mill may be impressed with the best qualities which the several uses of the metal demand.

As a knowledge of the geological place in the associated rocks, of the several layers of iron ore, coal, or limestone, is essential

to the successful tracing of their outcrop, and therefore to the determination of their continuity, and the area which they cover, I have made it an object of prominent importance to ascertain the succession, and, as nearly as time and means would permit, to measure the thickness of each band of sandstone, slate, shale, or limestone, included in the tract, and to locate in their proper places the layers of ore and beds of coal and fire-clay.

The results I have embodied in a graphical form, in two Geological Sections, representing the several beds of rock, and their included valuable deposits.*

In presenting the results of my observations, it will be convenient, as well as useful, to classify them under the following heads:—

Of the general Geological Structure of the District.
Of the several groups of Ore Beds.
General Remarks on the Ores.
Of the Coal Seams.
Of the Limestones.
Of the Fire-Clays.

OF THE GENERAL GEOLOGY OF THE DISTRICT.

The Laurel Hill range, upon and along the western flank of which the Company's land is situated, is a broad, moderately elevated mountain, prolonged from Pennsylvania, in a S. W. direction, for some thirty miles into Virginia, and forming the last conspicuous swell in the area of the coal bearing rocks. The strata comprising this mountain present what is called an anticlinal structure—that is, they come downwards from its centre towards the opposite sides of the ridge, and form, when unbroken, a continuous arch, the flat crown of which corresponds to the centre of the mountain. The inclination or dip of the strata, on the north-west side of the mountain, is towards the north-west; that on the opposite side, towards the south-east. This structure is clearly revealed in the grand gorge, or winding transverse valley, by which the Cheat River passes through the Laurel Hill.

Here, about midway between the opposite flanks of the range, are seen the peculiar sandstones and slates of a formation geologically far below the true coal-measures, but which sometimes includes a thin and delusive coal seam. These rocks form the upper part of the Vespertine series of Virginia and Pennsylvania geology. In a broad arch, externally concentric with this, is the group of reddish and buff sandstones and soft red shales, associated with a thick mass of limestone, and terminated above by dark shales, including several valuable layers of iron ore. This is the Umbral series of the Virginia and Pennsylvania geology. The

* These Sections have been omitted.

limestone and other hard rocks of this group form, on the sides of the great water-gap of the Cheat River, a line of cliffs in a long arch, high in the face of the hill, but still far below the true mountain summit. Next above, and exterior to this arch of umbral limestone, and overlying red and iron-bearing shales, is the lowest division of the true coal-measures—the Seral series of the Pennsylvania and Virginia geology. This is the great seral conglomerate, or the millstone-grit of geologists. It is a coarse and often pebbly gray sandstone, in massive beds; and when not removed by denudation, is seen crowning the mountain with lofty mural cliffs, such as the noted Raven rocks, the remnants of a continuous mass which once bent over the mountain in a grand, unbroken arch. Fortunately for the iron manufacturer, this thick cover of rock has been swept away over large depressed areas on the top and brow of the mountain, and access has thus been given to the iron ores imbedded in the next subjacent strata.

Above the great conglomerate, the series of strata embraces sandstones, often conglomeritic, slates, shales and limestones, with beds of coal and fire-clay, layers of iron ore, all included under the general title of coal-measures, or the seral rocks of the Virginia and Pennsylvania geology. The general dip of these strata on the western slope of the Laurel Hill, is towards the north-west, but becomes more nearly horizontal, and even takes a very feeble opposite dip, as we recede in that direction. This flattening and sometimes slight reversal of the dip has evidently the effect of maintaining the limestones of the Quarry Hill high in their extension westward into the hill of the Big Coal, and to give that seam a greater elevation above the river than with an undiminished western dip it would have maintained.

The coal-measures included in the Pridevale property, consist of the older coal group, the older barren shales, and the lower part of the newer coal group. The older coal group extends from the top of the great conglomerate or cliff rock, to the top of the lesser cliff, which lies above the four-feet vein of coal. Within this interval, generally, two or more workable seams of coal are included. The older barren shales occupy the interval between the top of the lesser cliff rock above mentioned, and the big or seven-feet coal. This group is chiefly composed of red and variegated shales, calcareous sandstones and ochreous limestones, and usually contains very little available coal.

The newer coal group contains, at its lower limit, the big coal, over which, as at Eclipse Rock, is usually a heavy mass of sandstone, and still higher in the series, two or three workable seams of coal. But these are geologically too high to be contained in even the loftiest hills on the Pridevale side of the Monongahela, and are met with for the first time on the high grounds some distance west of that stream.

OF THE IRON ORES.

For the sake of greater clearness of description, and as a guide for future explorations, I think it expedient to group the several ore-beds thus far discovered, according to certain geological boundaries, which are, for the most part, sufficiently marked to be easily determined. It must be borne in mind, however, that this grouping does not necessarily imply any special agreement in composition or richness of the ores so associated, although in some of the groups such a resemblance actually exists.

The First, or Martin Group of Ores.—The first or lowest group of ores, of which the Martin Ore may be taken as the type, is embraced in a mass of black, buff and brownish shales, and greenish shaly sandstones, lying beneath the conglomerate, and having an aggregate thickness varying from forty to fifty feet. This mass is separated from the conglomerate proper by some twenty or thirty feet of a rather fine-grained and tough sandstone, of a buff color, which is usually exposed at the base of the great cliff.

The ores of this group are, of course, accessible where the mountain is traversed by the river; but, in this position, are in general deeply covered and obscured by the accumulation of fragments of the conglomerate which have fallen from the cliff. They are, however, laid bare extensively on the high grounds near the centre of the Laurel Hill range, where, by great denuding action, the arching cover of the conglomerate has been swept off. Such are the conditions under which they have been found at the head waters of Quarry Run and its branches, and of Middle Run—the former flowing by the Henry Clay, and the latter by the Woodgrove furnaces. Beginning with the lowest band or bed of ore included in the group, I shall travel upwards, describing each in succession, as regards chemical character, geological position, and other particulars bearing on its economical value, as far as these have been ascertained.

The first or lowest ore of the Martin group, is that called by the miners the red-belt ore. This lies a few feet above the first deposit of red shale met with in this region, under the great conglomerate, and is hence very easily traced and identified. It has been mined along the outcrop quite extensively by benching in the immediate vicinity of the Henry Clay furnace. It is here chiefly a hematite, and is of fair quality, probably a forty per cent. ore when selected. In the benches no opportunity was presented for estimating the thickness of the bed. About a quarter of a mile below the furnace at the meeting-house, it has been drifted on by Carr, who states its thickness at eighteen inches; but the drift having fallen in, I was unable to verify his statement. At this point the ore is nodular carbonate, rather

coarse but heavy, and would, no doubt, produce well. It is almost certain that at some distance from the outcrop, and under a thick cover of rock, this bed would consist almost exclusively of the nodular carbonate, the hematite found along the outcrop being due to the modifying action of the atmosphere upon the exposed carbonate.

Besides the line of exposure, and of accessible mining of this ore, on the west and north-west side of the Quarry Run, ranging above and below the furnace, in all about half a mile, the red-belt ore, rising with the rocks in an eastwardly direction, shows itself at various places along the slope of the hill on the eastern side of the Run, in the neighborhood of Carr's dwelling.

The second ore of the present group is that known at the mines connected chiefly with the Henry Clay furnace, as the Martin ore, and at those which were wrought for Woodgrove, as the Gum Spring or Ross ore. These, I have satisfied myself, occupy the same geological position, and they agree in composition and in the associated rocks. This Martin ore is separated from the red-belt by some twenty-five to thirty feet of flaggy sandstones and shales, furnishing beds of excellent material for grindstones. It has been wrought by benching in a winding line along the face of the hills around the sources of Quarry Run and other neighboring streams, through a distance, on the Pridevale property, which, continuously measured, would probably amount to two miles. In all these openings I found, by the specimens left on the banks, that the ore is of nearly a uniform quality, being a blue nodular carbonate of iron, of rather fine grain, covered with a rich scale of red oxide. The ore is imbedded in black and ochreous shales, and consists partly of nodules, placed at irregular intervals in parallel horizontal courses, and partly of one or more layers of nodules, thicker and more closely placed. At the locality wrought by Mr. McKelvy last year, where alone I had an opportunity of inspecting the face of the ore, I found, in the upper ten feet of shales, exposed in the bench, four courses of nodules, equivalent, I think, to a continuous bed of six inches. Below these, and separated from one another by eighteen inches of the same shales, are the two main courses or layers, amounting together to about twelve inches. In some places, the aggregate thickness would perhaps be greater; in others, much less.

The shales associated with these layers, so far as seen exposed, are soft and crumbling, and have therefore greatly favored the deep benching which has already been so extensively carried into them. Along the line of these openings, there are many intervals where the same mode of mining may yet be continued; but the great body of the ore in these localities can only be reached by a systematic plan of drift mining, for which favorable positions could easily be found.

It is to be borne in mind, that the Martin ore, along a part of its outcrop on the Pridevale property, has not been mined in any way. The long hill-side, where the hematite ore is now mined, must, at a lower level, contain this ore, and would offer a favorable position for reaching it by stripping and shallow benching: and the same remark applies to the slope connected with the former, which lies nearly opposite to, but somewhat further up the turnpike, than the Martin banks, near the old furnace. It is highly desirable to have this ore traced and proved along the range referred to, as well as in other blank spaces which have not been benched upon. It is a productive ore, and seems to have been mined advantageously along the whole extent of the openings.

The Gum Spring or Ross openings are chiefly in this ore. These are situated in the slopes surrounding the head waters of a stream lying between Quarry and Middle Runs, and being nearer to Woodgrove furnace, were wrought, I believe, entirely for its use. Judging by the fragments of ore left on the benches, it does not differ from the material obtained at the Martin Ore Diggings above described, and its geological position is the same.

The great Cliff Rock is seen on the hill above its outcrop, at a level vertically over it of some forty feet. The benches expose black and ochreous shales, and are continued along the edge of a deep, winding valley, for upwards of half a mile. The scattered nodules of the upper part of the bench would be equivalent to a layer of three inches. The lower layers were covered up by the fallen shale; but, according to Carr, who wrought the mine last, they consisted of two adjacent courses, in all about twelve inches, a thickness probably not over stated.

The third ore of the Martin group is what, from its mineral association, may be termed the flint hematite. Its position, geologically, is some twenty or twenty-five feet above the Martin bed, and, like the latter, it is inclosed in a mass of black and drab and ochreous crumbling shales. The chief mining in this ore is in a line of benching along the eastern face of the hill which forms the western boundary of the comparatively level ground marked by the old mines of the Rock and Martin ores. Here its long line of outcrop affords favorable opportunities for drifting, as well as bench work. It has already been mentioned, that the Martin ore ought to be explored, in a parallel line in a lower level, and I may here add, that the Rock ore, or next higher bed, is to be worked for a short distance above it; but, as yet, the operations in this hill have been confined to the flint hematite.

In the drift now advancing in this bed, I found the ore proper in the form of an irregular stratum, varying from one to two feet in thickness, consisting of a dark brown, rather compact limonite,

or earthy hematite, including nodules or lumps of clay, and resting on a mass some two feet thick, of a nearly black flinty rock, which occasionally passes into an impure ore. I observed, also, in the overlying shales, irregular seams of an earthy variety of pipe ore. From this line of workings we may count with some confidence on an average thickness of fourteen inches, and I think we may estimate the strength of the ore, when properly culled, at not less than forty-two per cent. But care is needed at the ore heap to prevent too great an intermixture of earthy matter with the good ore. The large lumps obtained from the mine ought all to be broken, to release the ore from much of the included or adhering earth and flinty material.

The fourth ore of the Martin group is that known variously among the miners as the rock ore and England ore. This occurs also in dark crumbling shales, at a height of from twelve to fifteen feet above the hematite, or thirty to forty feet above the Martin ore. It has been very extensively mined by drifts and benches, on the level high grounds, from which the conglomerate has been swept off in the centre of the Laurel Hill axis. In the low hill, at the upper extremity of the railroad to Henry Clay, and near the head of Quarry Run, it forms a nearly horizontal sheet, at a small depth below the surface. Here it has been removed around the outcrop, and has been entered on nearly every side by drifts, leaving, I apprehend, but a small fraction of the original mass of ore in its place, and that in a condition difficult to be mined. There are points, however, in this locality, where, perhaps, it may be advantageously entered, although the remaining area of the ore is certainly not great.

In the old drift, which was re-opened for our inspection, I found the rock ore to consist of a layer of large nodules, or suggans, as the miners call them, consisting of rich blue carbonate, about five inches thick, associated with a dark bluish and purplish rock ore, made up of round granules, of a dark purplish brown color, imbedded in a bluish paste. This is properly an oolitic or fish-roe ore, a mixture of oxide and carbonate of iron, and passes into an oolitic limestone, with which, without some care, it is liable to be confounded. Excluding the limestone, I could not, from the exposure in the drift, form any exact estimate of its thickness; but the two ores together may, I think, be set down at ten inches. The miners who have worked in this locality, affirm it to have been much thicker; but it appears to have been in this respect remarkably fluctuating.

The England or rock ore, cropping higher than either the Martin or hematite ores, should be sought for along the whole extent of the hill sides, where either of these ores have been benched upon; and should the ore prove as good as in the old mines above described, the extent of accessible outcrop thus exposed, will impart to this bed great value.

The fifth, or last ore of this group, is a meagre, flaggy ore, intermixed with some good knots of brown limonite, which is obtained by surface stripping and shallow benching in the neighborhood of the rock ore mines, and is found in the olive shales and shaly sandstones that overlie the dark crumbly shales in which the rock ore is imbedded. No sufficiently extensive openings have been made in this layer to determine its value. Should it prove of real importance, it would be accessible along a great extent of outcrop.

From the geological position of the group of ores just treated of, it is evident that they must crop out in all localities where the strata next below the great conglomerate have been laid bare by denuding causes. As the lower ledge of the conglomerate rises from the bed of the Cheat, a short distance below the mouth of Quarry Run, and thence ascends to arch over the mountain, this stream has there carved its channel in strata subjacent to the conglomerate, and not far removed from the beds, including the Martin group of ores. Indeed it has for some time been known that the red-belt ore shows itself in this immediate vicinity; and in the course of my late explorations, I found, beneath the great cliff, a considerable thickness of dark shales, exposing nodular ore corresponding to the Martin or England beds. This locality is about one-eighth of a mile north-west of the mouth of Quarry Run, and is undoubtedly the geological place of these ores. But whether the beds would prove as rich and thick here as where the heavy cliff has been removed, is a point only to be settled by actual mining on the spot. On both sides of Quarry Run, near the Henry Clay furnace, these ores must also take their place. None of them, however, but the red-belt has yet been explored or mined in that vicinity.

The Second, or Stratford Group of Ores.—The second group of ores, of which the Stratford may be assumed as the type, is included between the top of the great conglomerate and the next superior mass of heavy bedded rocks. This overlying mass is a rather coarse, argillaceous sandstone, from twenty to twenty-five feet thick, forming, where well exposed, a distinct cliff, which, being the first mass of hard rocks above the Stratford group of ores, becomes a valuable guide in following their outcrop. The interval between the conglomerate and this, which we may call the Stratford Cliff rock, is occupied by olive, buff and blackish shales, passing into greenish and brown flaggy sandstones, and including thin beds of quite compact gray sandstone.

The lowest of this important group of ore beds, is that opened at Nick Carr's bank, and which we may designate as the Carr ore. Its place, geologically, is some twenty-five or thirty feet above the great conglomerate, and its crop is seen on the turnpike, near the Horsetrough. At Carr's opening, about half a mile north-west of the Henry Clay furnace, in the upper six or

seven feet of the bench, are scattered nodules of rich carbonate, and at the base a course of bluish plate or flag ore, in large oblong masses, from six to seven inches thick. These are regularly laminated, the layers being marked by different tints in the crop fracture, giving the whole mass the appearance of a laminated sandstone, or sandy slate, into which, indeed, the bed occasionally degenerates. The laminar surfaces of this, as well as the adjacent slates and sandstones, are occupied by carbonized remains of leaves and other vegetable impressions. The whole mass, including the nodules above, may be estimated at ten inches. It is a heavy ore, found to work well at the Anna furnace, and promises to be persistent. Below the heavy plate is a layer of much poorer rock or sandstone ore, some fifteen inches thick, and a few feet lower is a thin coal seam, the first met with above the conglomerate.

The second ore of the Stratford group is the Stratford ore proper. This lies about twenty feet higher in the strata than the preceding, and is separated from it by a coal seam, which at some points is said to be three feet thick—it is certainly, I think, as much as two feet. The ore lies in bluish or lead-gray shales, and where inspected by me, in a drift on the mountain road, consists of three courses of flat nodules, and larger roundish masses of blue argillaceous carbonate, making an aggregate thickness of about ten inches. A long line of benching has been pursued on the outcrop of this ore, eastward of the drift in question, and from what I heard and observed, these mines have furnished a large amount of ore. The ore is a compact, sometimes rather rough and sandy carbonate, but it will yield well for an ore of this class. The shales along the outcrop are crumbly, and easily removed; but in the drifts examined, they show a degree of compactness which must add somewhat to the cost of mining. These, as well as the Carr ore, have a long line of outcrop yet untouched, to which hereafter attention may be properly directed.

Above the true Stratford bed, at a distance of about twenty-five feet, we met the third ore of the present group, the Black-band ore. This, as indicated in its name, occurs in a mass of black and dark gray shale, the crop of which is seen on the mountain road, a short distance west of the Stratford drift. This should not be confounded with the peculiar black carbonaceous ore found in the Scotch and English coal-measures, known as the black-band, and which is of a black color. In the present case it is not the ore, but the associated shale that has that hue. Still further west, or down the mountain, it has been opened below the road, at a point adjoining the old opening of the Stratford ore. Here the black-band discloses itself in two courses of large irregular nodules of good ore, in all about eight inches thick, the upper consisting of carbonate with brown oxide, the lower chiefly of the unaltered carbonate. This ore is to be

looked for above the Stratford band, along its outcrop generally. At the old opening just referred to, owing to a slip or displacement of the strata, the ore could not be confidently pursued.

Above the black shales of this bed are sandy slates, and olive and bluish shales, and flaggy sandstones, occupying a thickness of about thirty-five feet. These in the outcrop on the turnpike give some indications of ore, and mark, as I think, the general position of the ore beds recently opened on the Duval Creek and on Middle Run.

The former of these openings, a little more than one mile north-east of the Anna Furnace, exposes a thick mass of bluish-gray sandy shales, the laminæ of which are crowded with the remains of plants. Near the top is a layer of nodular blue carbonate of excellent quality; below this, two courses of large nodular masses or suggans of inferior quality; and at bottom another layer of the heavy nodules; making in all about five inches of good and about ten inches of a poorer but still available ore. This mine is near the dwelling of John Coles, by whom it is worked, and is not on, but adjoining, the Pridevale property.

The other opening, known as Sam. Cole's Mine, embraces both sides of Middle Run, and brings to view a similar series of bluish sandy fossiliferous shales. In the upper part of the bench are a few small nodules of heavy blue ore; beneath these a plate, about two inches thick, of sandy but moderately good ore; and at bottom a layer from twelve to twenty-one inches thick, composed sometimes of large suggans of a rather meagre but probably available shelly ore, inclosed in shale, and sometimes of a rather variable bed of highly ferruginous bluish shale, which, taken in the mass, can be of little or no value as an ore.

Farther up the stream, both here and at the preceding locality, we should look for the lower Stratford ores before mentioned; and between the openings on Middle Run and the old Stratford Mines on the turnpike, a distance of more than two miles, there is great scope for mining in all these layers of ore, by benching as well as by drifts.

The recent opening on the mountain turnpike, near the Horse-trough, is evidently in the upper beds of the Stratford group, and from the general richness of the layers exposed, gives promise of a persistent value in these as well as the lower Stratford ores. This should encourage exploration along their outcrop close in towards the base of the Stratford Cliff above described.

The Third, or Norris Group of Ores.—This assemblage of ore-beds is included between the upper limits of the Stratford Cliff rock, and the bottom of the four-feet vein of coal, an interval of about one hundred and ninety feet, embracing shales and shaly sandstones, and beds of coal and fire-clay, and in some

localities one or two thin and variable courses of limestone.

The lowest of this group, the Norris Ore, has its place near the upper limit of a mass of shales and shaly sandstones, which, in geological position, is next superior to the Stratford Cliff rock. This ore is found in and directly beneath the bed of fire-clay which supports the Norris vein of coal. It is chiefly a brown oxide or earthy hematite of good quality. Above the coal, which at some points is a good seam, three to four feet thick, is another mass of fire-clay, of a compact and fine grain, called here whetstone, and which has been very largely dug for the manufacture of fire-brick. Resting on this is a thin plate of coal. Little ore is found in the upper fire-clay, but I learn that a good thickness was mined in the benches extending through the lower fire-clay. The openings of the Norris ore have been thus far confined to so much of the broad slope of the mountain west of the Stratford Cliff rock, and lying over it, as intervenes between the mountain road and the head of the next great hollow towards the north. Here the fire-clay and ore have been benched upon over quite a large surface. There is still, I think, a good extent of the outcrop of this ore, and the associated valuable materials, which remain untouched.

Above the Norris coal, and separated from it by some twenty or twenty-five feet of shales, occurs the second ore-bed of the present group, which, from its usual association with limestone, we may call the limestone ore-bed. It lies a few feet beneath a thin coal seam, and is associated with fire-clay, shale, and a rather ferruginous limestone, into which, at places, the ore seems to graduate. No important opening has, I believe, been made in this ore-bed, and its value remains to be determined by future explorations.

Passing an interval of some thirty feet, occupied by shales and shaly sandstones, in which no ore has yet been explored, we reach the level of another thin coal vein, above which, in the gray and buff sandstones and sandy shales, occurs the third ore-bed of the present group—the one recently opened by Clellan in the hollow, about three-quarters of a mile east by north of the Anna Furnace; this lies a few hundred yards higher up the hollow than the drift of the four-feet coal once wrought here. In the bench thus far laid bare, are three courses of nodules in bluish sandy shale; below these a thin layer of coarse plate ore, and at the bottom of the bench, a double flag of laminated sandstone, about twelve inches in thickness, impregnated with carbonate of iron; another course of sandstone, containing still less iron, lies some fifteen inches beneath the latter. The twelve-inch flag above mentioned, is in large part nothing better than a ferruginous sandstone, and will, I think, be found worthless as an ore. In the mass, it certainly cannot contain over ten per cent. of iron. Parts of the upper layer, and all the heavy

nodules, are of pretty good quality, but, unless the opening should prove more productive of good ore than at present, I would advise its being abandoned. Search should be made in the shales some twenty feet above, and as much below, for other and perhaps more favorable openings. This interval appears on Decker's Creek to have furnished some good ore.

It is, I think, in the space next above the Clellan ore, that we are to place the Ashby ore of the Woodgrove tract, which, therefore, provisionally, we may designate as the fourth ore of the present group. The Ashby ore has been extensively mined, by benching around the face of the hill, on the south side of the valley of Middle Run, between one-quarter and half a mile from Woodgrove Furnace. It occurs in a drab and ochreous shale, associated with black, crumbling slate, and probably a thin plate of coal. The mining having been discontinued some years, no opportunity was afforded for determining the thickness of the bed. From the miner who had wrought in this ore, I learned that it lay irregularly in the shale, sometimes a foot, and sometimes much less in thickness. The fragments left on the benches, prove it to have been a brown oxide ore of good quality. The old benching has, I think, removed as much of the ore from this line as can be conveniently or cheaply reached by this method; but the line of benching admits of being extended, and this ore merits an early exploration, as its quality, and its vicinity to Woodgrove, would give it, if in sufficient quantity, very great value.

A hematite has been opened on the face of the hill, on the opposite side of the run, which seems to correspond in geological position to the Ashby ore. The extent of this will probably soon be made known.

Returning now to the section in the vicinity of the Anna Furnace, we meet, at the height of some fifty feet above the Clellan ore, a bed of fire-clay, containing at bottom nodules of ore, and overlaid by the small coal seam known as the Blacksmith vein. These are immediately overlaid by a mass of heavy bedded argillaceous sandstone, which, at a short interval, is capped by the four-feet coal. The ore beneath this ledge, and associated with the Blacksmith vein, is now being explored along the turnpike, at a short distance below the ledge in question, and was formerly dug into further up the road, a little below its level. It here furnished some good brown oxide.

Above the sandstone just mentioned, (which has here a thickness of upwards of twenty feet, although entirely wanting on Decker's Creek,) we meet the fire-clay and shales subjacent to the four-feet coal. In these there occurs what here, as well as at Decker's Creek, has long been known under the name of the Swisher ore. This was at one time largely mined on Decker's Creek, where it formed a band of from six to ten inches of

heavy carbonate and oxide, and was accompanied by a stratum of limestone. This limestone band is absent in the vicinity of the Anna Furnace.

Considering the coal seam at Woodgrove as the equivalent of the four-feet vein of the Anna Furnace, the limestone ore which is found beneath that seam would correspond nearly, if not exactly, in geological place with the Swisher ore. Where examined by me in the drift near the meeting-house, a little north-east of the furnace, this ore forms an irregular bed, lying upon, and more or less blending with, an argillaceous limestone —the two together making a thickness of two feet, of which one-third may be estimated as ore. Two feet of calcareous fire-clay intervene between the ore and the bottom of the coal, the thickness of which at this drift is about three feet. The ore is throughout more or less calcareous and argillaceous, but in the main it is a rather rich carbonate of iron.

An ore corresponding in position and character to the Swisher ore, has been opened at the head of the hollow in which Clellan's mine is situated, and is known as the Butler ore. It occurs beneath, and quite near the four-feet vein of coal, which crops out on the ridge at a short distance higher up, and from its richness and reputed thickness, deserves to be carefully examined along the extensive line of outcrop in which it is here accessible.

The Fourth, or Haines and Shake-den Group of Ores.—This group is included between the four-feet and two-and-a-half-feet seams of coal—an interval of about one hundred and eighty feet—composed below chiefly of coarse and sometimes conglomeritic sandstones, and above, by crumbly argillaceous and calcareous shales.

At the Anna Furnace it consists of two belts, the first or lower of which has been for some years mined under the name of the Haines ore. The Haines ore lies in a mass of buff and olive shales, some twenty feet in thickness, interposed between the two very thick masses of sandstone which are largely exposed in the hill-side immediately east of the Furnace. The lower of these masses, about forty-five feet in thickness, forms the cliff next above the four-feet coal; and the upper mass, which is thicker, and includes beds of coarse millstone conglomerate, and which in its western dip sinks below the Cheat, a little west of the furnace, forms the cliff at a still greater elevation. The Haines ore-bed in this vicinity has been mined at several points, and has furnished a brown oxide of very good quality. It is accessible at numerous places along its outcrop, in the lowest bench of Laurel Hill, from the Anna to Woodgrove Furnace. On the slope east of Duval's, (the old Post-office,) on both sides of the stream which flows past John Cole's opening in the Stratford ore, at a distance of about one-and-a-half miles from the Anna Furnace, this ore has been mined extensively,

and some of the benches recently wrought have been found quite productive, both as to the quality and thickness of the bed.

In the immediate neighborhood of the Woodgrove Furnace, the ore which I deem geologically equivalent to the Haines ore, may be traced for a considerable distance along its outcrop. It lies in the shales, separating the two cliffs of sandstone, which display themselves in parallel ranges in the hill, extending from opposite Woodgrove, in a north-east direction, along the margin of the northern fork of Middle Run. Here I found the shales to contain nodular carbonate of iron, and I have no doubt that some ore of this description has been mined in the benches of the vicinity; but most of the Haines ore here, as well as near the Anna Furnace, is the brown oxide produced by the decomposition of the carbonate. In the recent explorations, from one-third to one-half a mile above the Woodgrove Furnace, in this line of outcrop the oxide or coarse hematite is exposed in a thickness of from six to fourteen inches.

Near the Anna Furnace this ore appears to have been uniformly of good quality, often in very large irregular lumps, approaching the character of hematite, and in beds varying from six to twelve or fourteen inches. Hitherto it has been mined exclusively by stripping and benching.

As the Haines ore is one of the most persistent in thickness, and one of the purest and richest brown ores met with in this region, it deserves to be systematically pursued throughout its entire outcrop, and in suitable places to be explored by drifting.

The Utt ore of the Woodgrove neighborhood, occurs at a lower level in the rocks than the Haines ore. At the old diggings, about one mile north-east of the furnace, this ore is seen in a fire-clay shale, a few feet below a heavy-bedded sandstone, corresponding, I think, to the lower of the two cliffs before mentioned. Twelve or fifteen feet below the ore, a coal seam about three feet thick has been opened, which I am inclined to regard as the main Woodgrove vein. The Utt ore would, in this view, be in the shales immediately above this coal, and beneath the lower of the two cliff rocks. Where exposed, it is a meagre earthy brown oxide, and would seem scarcely worthy of further pursuit.

The second ore within the geological limits now treated of, does not present itself clearly at the Anna Furnace, but forms a very important bed at Woodgrove, where it is known under the title of Snake-den ore. The position of the Snake-den ore at Woodgrove is at a level, some twenty feet above the upper cliff rock at the Woodgrove Furnace, and about fifty feet lower than the coal seam of that vicinity, which I regard as identical with the two-and-a-half feet vein of the Anna Furnace.

The Snake-den ore at Woodgrove has been traced and partially benched on the hill next westward of the furnace, follow-

ing, at a short interval, the upper level of the cliff rock, and with this descending westward until it sinks below the bed of Middle Run, about half a mile below the furnace. It consists usually of a single course of massive rock-ore, varying from five to ten inches in thickness, overlaid by crumbling shales and clay. It is divided by rectangular joints, or natural partings, into blocks of a square form, which, in mining, are readily separated from the bed, and lifted without any mixture of impurities. The ore is in reality a bluish rock, at times sandy and micaceous, highly charged with carbonate of iron, which, for some depth, and often throughout, has been converted into red oxide of iron. In the unchanged interior it contains quite a considerable proportion of carbonate of lime, along with carbonate of iron, and taken in mass, as presented on the ore heap, is to be regarded as decidedly calcareous ore. It is unquestionably well charged with iron, but deserves a very careful analysis for its lime and other ingredients. The form of the land along and near its outcrop will render it accessible by shallow and easy benching over a large surface, and its persistency throughout the extensive line over which it has been explored, gives assurance of its abundance. From the general shallowness of its cover throughout this range, we may anticipate no material diminution in the oxide crust or shelly portion of the ore.

A careful examination of the geological place occupied by this belt of ore at Woodgrove, both in regard to the small coal seam above, and the cliff sandstone below it, leaves no doubt as to the position in which it should be found in the neighborhood of the Anna Furnace. This would place it among the olive shales and shaly sandstones on the river road, beneath the store, a short distance lower down the river than the Furnace. Here, however, it does not present itself in a regular bed as at Woodgrove, but in the form of nodular masses, bluish within, and deeply covered with a brown scale, occurring rather sparsely in one or more thin beds of whitish fire-clay shale. The ore, both internally and externally, resembles the best of that which is mined near Woodgrove; but thus far, at this point, it has not disclosed itself as an available bed of seam.

As the Snake-den ore has been clearly traced from the Spring Hill Furnace to Woodgrove, and from the latter point to within half a mile of the Anna Furnace, its absence, in any available amount, directly at the Furnace should not discourage efforts to find it on the property of the Company, within this as yet imperfectly explored interval. There can be no doubt that the ore formerly dug at Baker's, half a mile distant, belongs to this band. The two-and-a-half feet coal, which forms a valuable guide in this tracing—lying high in the shaly hill facing these openings on the west—shows itself in a field somewhat nearer the Furnace, and is evidently caught just at its outcrop

in the slope of the Meeting-House Hill as it descends towards the brook north of the railroad. The form of the ground in this vicinity is such as to make it certain that the strata, including the ore—and we may hope, therefore, the ore itself—crops out in the hollow of this brook, at a lower geological level, however, and therefore somewhat further west than the hill-slope on which the coal-wash has been exposed.

It is a point worthy of special note, but which seems hitherto to have escaped detection, that the Snake-den ore, in chemical and mineralogical characters, bears the closest resemblance to the Scott ore, which, on Decker's Creek, and at the Clinton Furnace, has proved so permanently productive. Their identity in regard to geological position is not so susceptible of exact determination; but my observations on Booth's Creek, near the Clinton Furnace, were sufficient to prove that the Scott ore lies in the same general belt of rocks with the Snake-den ore, and is truly, in that region, its equivalent. A systematic and thorough exploration of the ground here referred to, by means of ditches or costines, ought early to be made—as the vein of ore, if in force here, would, from its proximity to the Furnace, be of very great value.

The deposits of ore next to be examined, are, strictly speaking, partly within and partly above the limits of the present group. These deposits consist of an earthy and sandy brown oxide, found very near the surface of the level tract which extends from the Anna Furnace for some distance along the base of Laurel Hill. The ore has been dug at several points quite near the Furnace, and at Bowers and other places in the neighborhood. At all these localities it occurs in the loose sand and gravel which overspread the flat, and it is not directly associated with any of the subjacent strata. Considered in regard to its origin, it belongs to the class of bog ores, formed by the infiltration of water, charged with iron, into the loose surface materials. Deposits of ore of this kind naturally suggest the proximity of ore-beds of original formation, from which the water has derived its charge; and in many cases bog ores are actually traceable to this source. But it even more frequently happens that the infiltration comes, not from the seams or deposits of ore, but from shales and slates, containing much diffused sulphuret of iron, which, through the action of the air and water, furnishes soluble compounds of the metal to the percolating rains. The ore of these superficial diggings near the Anna Furnace, is often quite rich, and being accessible over quite a large area, is of some value as a local resource.

[To be continued.]

ART. II.—ON THE DECOMPOSITION OF ROCKS, AND THE RECOMPOSITION OF THEIR METALLIC CONSTITUENTS.—BY JOHN CALVERT.*

THE large quantity of gold found in the detritus of Australia, California, and other acknowledged gold regions, has called forth much speculation from many scientific minds as to the origin of so much alluvial gold, when the sources from which it appears to emanate (viz., the quartz vein) have so generally failed to produce it on being entered into or worked below the surface, thereby causing so much disappointment to gold mining speculations, the promoters thinking they had only to rip open the goose to insure to themselves a plentiful harvest of golden eggs. The delusions and failures of gold quartz companies are such acknowledged facts, that it will be unnecessary for me to enter upon that part of the subject here. The origin or development of gold may be thus classified, viz.:

1. When precipation takes place simultaneously with the intrusion and upheaval of palæozoic formation.

2. An after-precipitation, through the electric and atmospheric decomposition of the various rocks and metalliferous formations.

But a small portion of the gold we use owes its origin to the first circumstances; and gold having a surface determination, it will always precipitate itself there, and therefore would long ago have been an extinct metal in inhabited countries, were it not for the fact of the after-precipitation and development which is always going on wherever the matrix containing it is thrown under circumstances sufficiently kind to render the decomposition of the matrix favorable to the recomposition of the gold it may contain.

By far the greater portion of the gold we obtain at the various diggings and mines owes its realization and development to this after-precipitation. The vast granite ranges in Australia and other places, the flanks of which are so constantly undergoing decomposition, and keeping up the supply of detritus and sand in the rivers and creeks which flow from them, are not found to contain any gold at the head of the said creek, or in the granite detritus, until it has been washed into hollows, and beds of creeks and rivers, in company with an accumulation of organic matter; then, when sufficient moisture, the battery-power is active enough to precipitate the gold in nodules of various sizes, just in the same way that flint forms in chalk, or iron in bogs. An atmospheric decomposition of granite, containing a very small quantity of any other metal, is not sufficient to develop the gold it contains; but in the case of many of the

* *London Mining Journal.*

various metallic ores, when in their combination exists sufficient of the opposing metal to create a self-acting battery, they will, after being exposed to a succession of winters' rain and summers' heat, be decomposed, and the gold and other metals it contains will be found to have recomposed themselves in other chemical states. But in many cases of rapid decomposition the waste of such a tender electric metal as gold will be very great, and more especially when decomposed by heat.

Nature's workings are beautiful, but in many instances very slow. Now, with regard to the gold in England, I have shown in my book, by many facts of history and tradition, that large quantities have been obtained at various periods. The English gold-fields, therefore, cannot be put upon a par with the virgin ground of Australia and other places, where Nature has been undisturbed and quietly producing it for many centuries, perhaps ever since that continent existed; still there are a few patches of ground here which have escaped the craving thirst of the ancient gold-diggers, and may yet be worked in England with a profit. Of those few isolated veins and spots that contain sufficient precipitated gold to pay for working, but two or three have been discovered and made known, and none properly worked.

If we would work gold in England on a large scale, we must seek it in other forms than its precipitated or metallic state; or the alternative will be to vigilantly search for the comparatively small quantity precipitated, and having worked that, wait patiently for some centuries whilst Nature accumulates more. I have watched the decomposition of rocks in many countries, have studied this subject the greater part of my lifetime, and have long since fallen into all the blunders and errors that so singularly characterize the gold-seeker's career, and which seem to so engross the public mind at present.

Whilst on my geological researches in Australia, in 1846, I discovered a boulder of granite, partially imbedded in rich black soil, at the side of a river; it seemed as though it had been undisturbed for many years, it was in a state of decomposition. On the under side it was mostly decomposed, and tinged with the oxide of iron; I could pick that part to pieces with my fingers; there were visible nodules of gold in all that portion that yielded to my fingers; there was no gold visible in the upper portion. This was a problem set me by Nature, which I toiled for many weeks and months to solve; many were the experiments and methods I fruitlessly tried. I could decompose the upper portion of that block of granite, but the gold was wanting. After some time I travelled back to the spot from which I had obtained it, carefully watched the chemical and electric conditions under which it had there been acted upon. I returned, tried fresh experiments, and succeeded in decomposing

a piece of the upper portion of the granite block: the only difference was, that the grains of gold I obtained were smaller than those formed by the natural process. Ever since that time I have been able to perform the same experiment successfully upon rocks and ores, providing they contained any.

Now, as the great and Almighty Providence has so generously seen fit to invest in man the power to assist and force so many of Nature's productions, may it not likewise be within his scope to forestall Nature's decomposition of the vast masses she so slowly attacks, and by artificial means to perform that in a week or month which otherwise would take years or centuries?

As to the exact geological period at which the palæozoic rocks became severally charged with gold, and under what electric law and then existing condition of polarity it was dispelled and distributed, is beyond the limits of this brief paper to discuss; sufficient for my present subject that it has been found locally distributed in the older formations, and in the debris accumulated from them, over the whole world, wherever it has been looked for. All the largest masses of gold that have been yet found show undoubted proofs of having emanated from various quartz veins, and to have been mere surface incrustations belonging to those veins.

I have often stated that gold has a surface determination, and I believe all that found its way to the surface, simultaneously with the formations being charged, providing the temperature and magnetic force were congenial, immediately precipitated itself there.

In my last paper I divided my subject into two classes:—

1. When precipitation takes place simultaneously with the intrusion and upheaval of the palæozoic formation.

2. An after-precipitation, through the electric and atmospheric decomposition of the various rocks and metalliferous formations.

I do not mean to convey the idea that all the ancient intruded rocks have charged the surrounding formations with gold; that gold may now be found in some of the oldest granites is a fact beyond doubt, but I believe it owes its presence there to some of the youngest and most recent intrusions and disturbances (which I have already explained in a paper I read before the British Association last year, and likewise alluded to in the 18th chapter of my book on the *Gold Rocks of England*)—patches and portions only of the surrounding rocks become charged; in many instances boulders of granite that have travelled from their original position contain none, whilst the mountain mass, from which they seem to have been torn, is largely charged with it. For instance, take the districts of Maneroo and Gipp's Land, in Australia, where you will find scattered over their extensive plains two distinct classes of boulders, both of which seem to have travelled many miles, and in some instances both seem to have arrived at pretty nearly

the same place, but evidently by different routes, and most certainly at distinct and widely intervening periods of time. The oldest boulders are mostly polished, and some appear much ground, and are all in good preservation; in no one instance did they contain any gold when operated upon by my decomposing process, when tracing them to their apparent original source —viz., rocks forming part of the Snowy Mountain range, I found Nature was making great inroads upon them by rapid decomposition, but upon subjecting a portion of the solid rock to my process, it gave me gold. I likewise washed some of the debris from the bottom of a creek close by, from which I obtained little angular nodules of gold. As to the more recent boulders, most of those I tried contained gold. Many of these were under various stages of decomposition, and most likely owed their boulder origin to the decomposition of the external mass, and the spherical flakes which the frost is daily splitting off from the angular rocks that are constantly breaking away from the mountains, from which they have been drifted.

Since I have been in England, I have experimentalised upon many granites, and other rocks and ores, from different localities in England, Ireland, Scotland, France, Nova Scotia, and other parts of the world, with success. I have not been able to obtain, up to the present time, any gold from the boulders of granite that have been drifted by the eastern and south-eastern drifts across Yorkshire, and the county of Wicklow, or from any of that hard white quartz which constitutes so many of the cross-courses of Cornwall. I have singularly failed upon many of the gossans lately reported to be so rich in London.

The ores I have found to be the most productive have been many of the mispickels of Cornwall; gneiss, with layers of mundic, similar to that from Lostwithiel; some of the more solid and earthy gossans, better if they contain a little sulphuret of iron, like those found at Halloon Mine, in Cornwall; likewise antimony, bismuth, copper, silver-lead, and blende, when associated or combined with either sulphur or arsenic, or both.

When gold is found accompanying magnetic iron, wolfram, the surface oxides of tin or iron, ferruginous earths and clays, it will always be in its metallic state. Iron, antimony, blende, and several other opposite metals, will often precipitate gold in veins below the surface, provided there is some flookan, or other moist ground, accompanying the vein, to allow of a sufficient strength of electric current to throw down the metal.

Mercury will never touch gold in any other than in its metallic state; and wherever mercury will obtain gold, it may likewise be obtained by careful washing; there is no mystery in the subject, for if you have metallic gold in your ores it is one of the simplest matters to extract it.

As to roasting the ores, that is one way of getting rid of

sulphur, arsenic, bismuth, and other volatile substances, so frequently found associated with gold; but it is likewise a capital mode of dissipating a great portion of the gold, if not all, and may never be performed with impunity, unless the gold is in the form of pure grains or strings. In nearly all cases where the gold is non-metallic, and even where it exists in its delicate and almost invisible feathery form, interlacing itself with some of the most teacherously volatile metals, it would be indiscreet to subject the ore to so violent an electric decomposition as it would most certainly have to undergo in the calcining or roasting furnace.

I am sorry to see the subject of the chemical conditions and arrangements under which gold may be volatilised at a low temperature, so little understood. The rocks and formations into which gold has been charged in its most subtle and hidden form are many of the limestones, shales, talcose, chloritic, and other schists, quartz, gneiss, granites, and many of the formations, ranging from the carboniferous series downwards. Granites that have not been re-disturbed will never contain any; the syenites, and other recent hornblendic intrusions, seem to have been the most prolific in charging their surrounding formations with gold. I havefrequently found gold in the red surface earth near trappean rocks; and most veins carrying sulphur, that seem to be in any way distorted by it, will, with very few exceptions, contain gold in one or other of its delicate chemical forms. In Flintshire, I have seen gold, blende, lead, and coal, all in the same piece of limestone, and from other coal localities have frequently found it in carbonate of iron and lime, but they have always been near to the surface.

I have so frequently cautioned the public against the delusions of surface gold—but they seem more inclined to purchase their experience by many thousand pounds of outlay, for gold is such a tempting bait—that it has caused some of the most honourable and best-disposed men, inadvertently to lead many of the over-confiding public astray. If more attention had been paid to my gold paper, read before the geological section of the British Association, last year, many disappointments would have been avoided, and much capital saved. No, they preferred being led astray by better prospects than I offered. Cabs tore about London, freighted with supposed gold ores; men sallied forth with their pockets laden with quartz and gossan; machines went round, and gold was produced in miraculous quantities; and if only half had been true that was represented to me, the owners of a few patches of gossan and quartz rocks, would have been by this time in a position to carry on the whole war of Europe at their own private expense.

There are several companies now at work, who seem quite surprised that their gold is failing them. I would simply recommend the promoters of these undertakings to look for the surface

stuff which led them into the adventure. Look after the old men's leavings, which will be found most likely to have been contemptuously neglected; and wherever their gold lode has been exposed to the atmosphere for many years, let them work up that, and extract all the gold they can from their surface skimmings, and take particular care of what they get; for it will be a long time before they get any more, unless they have recourse to some method of artificially quickening Nature's desultory proceedings.

ART. III.—ON FUCHS'S METHOD FOR THE DETERMINATION OF IRON.—BY J. R. BRANT.*

To determine the amount of iron in any substance, Professor Fuchs of Munich proposed (Erdmann, xvii. 160) a method which for ease and rapidity of execution is unequalled. It consists simply in boiling the solution of the perchloride of iron with a strip of bright sheet copper, until the iron is reduced to protochloride, the reaction being $Fe_2Cl_3 + 2Cu = 2FeCl + Cu_2Cl$. The quantity of iron is then calculated from the loss of weight of copper, for according to the reaction, as the atomic weight of copper is to that of iron, so is the loss of weight of copper to the quantity of iron sought.

As the idea contained in the method is capable of many analytical applications, it becomes a matter of interest to determine first the accuracy of the method itself. The iron used in the analyses was fine piano forte wire, and as a preliminary experiment the copper, which was of the purest Lake Superior variety, was boiled for one half hour in concentrated chlorhydric acid, with a loss of 0.69 per cent., and in acid of about one quarter the strength, 0.11 per cent.; showing that the very dilute free acid, in the solution of the perchloride, can have no sensible effect on the result.

	Iron taken.	Copper dissolved.	Iron found.	
I.	2.0074	2.2010	1.9441 — 96.84	per cent.
II.	2.0591	2.3065	2.0372 — 98.94	"
III.	1.9262	2.1811	1.9265 — 100.01	"
IV.	1.6682	1.8875	1.6671 — 99.93	"
V.	2.2574	2.5045	2.2121 — 97.99	"
VI.	2.0084	2.2855	2.0187 — 100.52	"
VII.	1.9807	2.2015	1.9445 — 98.17	"
VIII.	2.0671	2.3074	2.0380 — 98.59	"
IX.	2.0618	2.3380	2.0651 — 100.16	"
X.	1.0637	1.1907	1.0517 — 98.87	"

The analyses show that although the iron is reduced to protochloride, the change in color of the solution does not indicate with

* Silliman's *Journal.*

sufficient sharpness the exact time when such reduction is complete, thus rendering the method inaccurate and unreliable. The method can be made to give accurate results, as soon as some unobjectionable process is given whereby the reduction is rendered manifest independent of mere change in color.

Since the above investigation was completed, a paper on this same subject has been published (Erdmann, lxi. 127) by Dr. Julius Löwe, in which he states that the method, in point of accuracy, leaves nothing to be desired, and gives as proof the following examples:—

	I.	II.	III.	IV.	V.	VI.	VII.
Taken,	0.185	0.161	0.126	0.212	0.084	0.282	0.202
Found,	0.179	0.158	0.122	0.212	0.081	0.278	0.201
Difference,	0.006	0.003	0.004	——	0.003	0.004	0.001

Although in these analyses the absolute difference is very small, unfortunately the error in parts per cent. is large; expressed in this manner we have:—

	I.	II.	III.	IV.	V.	VI.	VII.
Found,	96.75	98.13	96.82	100.00	96.42	98.58	99.50
Difference,	3.25	1.80	3.18	———	3.58	1.42	0.50

Löwe's own analyses prove, then, that in point of accuracy the method leaves much to be desired; while by his inconsiderate manner of stating his results, he has deceived himself, and probably many others.

Art. IV.—THE VENTILATION OF MINES AND COLLIERIES.*—By John Phillips, F. R. S.

VENTILATION POWER.

The means of ventilation at present employed in the district of the Tyne, Wear, and Tees, may be classed under four heads:—

1. What may be termed natural or accidental ventilation; depending upon the tendency, which is very frequently observed, of the warm air of a mine to ascend one of two shafts rather than the other; whether they be sunk to the same or to unequal depths. When there is only one shaft, the air will frequently enter at a level, which in fact may be for such purposes regarded as a horizontal shaft. This tendency is not so strong or permanent as to be free from reversal under particular atmospheric conditions; and its effect, when constant in direction, is subject to variation in amount; the draught of air being least in summer and strongest in winter. Very few collieries are worked in

* Continued from page 281, Vol. III., No. 3.

this manner at present, and these only to small depths, and near the outcrop where the coal is drained of fire-damp. They are, however, liable to choke-damp, which, being extricated from the still shallower "old workings," frequently enters the mine, especially in damp warm weather, during particular winds and other unfavorable states of the atmosphere. The men may then be obliged to abandon work, and leave the mine for a time.

In Derwent Main Colliery, the circulation of air was found (in winter) feeble, but there was no sign of impurity in it; the coal cropping out all round, and thus being drained of effluent gases by easy channels to the surface.

2. To obviate the ill effect of these circumstances, and render the workings regular, one of the shafts is warmed in a slight degree by the heat of the "lamp;" that is to say, an open iron grate, set at the base of the shaft close by the "onsetters," who attend to hook and unhook (or slide in and out) the corves or tubs. The effect of this lamp is commonly found to be a current of a few thousand feet in a minute. For example, at Holmside Colliery (in Five-quarter seam), the current was found to deliver 8,900 feet in a minute, and, the day being unfavorable, the air was rather "black" from passing in its course through old workings adjoining the entrance by level.

3. In the next stage of ventilating practice the natural and accidental facilities for the circulation of air are in a great measure disregarded, and replaced by the action of one or more furnaces set to one or more shafts, and constantly kept in strong action by men appointed for the purpose. When seen in a high working condition—as, for example, at the base of the upcast shaft of Lyons' Pit (Hetton), where three great furnaces are kept fiercely burning by the assiduous labor of men, who by much practice, and by the indications of rude anemometers placed near, have a perfect knowledge of the process they regulate—the effect is admirable. Constant, regular, manageable, economical, expansible, simple, and effective, the ventilating furnace of the Tyne, Wear, and Tees, well seconded by a good arrangement of air channels under ground, and crowned by a shaft, employed solely as a chimney, is an excellent source of air-movement.

Even when the underground channels are impeded, and the upcast shaft is filled with the machinery for drawing coal, or, still more unfortunately, employed for pumping water, the furnace, though then limited in its power, produces more satisfactory results than might be supposed. It is, in fact, and has long been, the source of power by which the great collieries have been won and worked, and is applied with success to deep and shallow workings, wet or dry, yielding much, little, or no fire-damp, shafts of extremely unequal proportions, and clear, complicated with machinery, or divided by brattices of wood.

4. Though at different times air-pumps and revolving fans have been used to extract the air from the collieries of the north, there is nothing further to be noticed, as of actual application, than the occasional use of the water-flash (water allowed to fall in the downcast-shaft), and the steam-blast (steam rising in the upcast shaft). The action of these two forces is similar, but contrary: water in falling scatters into expanding lines of drops, and carries down with it a great quantity of air lying between these drops, to which it communicates motion; steam, while flowing violently upward, expands and urges with it, involved in its attenuated mass, a great body of air to which it communicates its own impulse; the warmth, which is the main spring of its power, continuing to produce some auxiliary effect in the higher parts of the shaft.

There have been several trials of the steam blast (in small jets under high-pressure) in the collieries of this district, by which its power to draw after it strong currents of air has been proved; in one of these (at Seaton Delaval), it is in constant work; it is in daily use in a few of the manufacturing establishments on the Tyne. At the alkali works of Messrs. Bell, Shields, the force of one steam jet, 5-16ths of an inch in diameter, derived from an engine-boiler of 20 horse-power, is found to draw the products of combustion from the furnaces, along a 12-inch pipe, many yards, then upwards and again downwards through coke-filters 60 feet high, finally rushing out of an iron pipe many yards from the entrance of the furnace. I learn that three jets, each 1-8th of an inch in diameter, are found powerful enough to draw the smoke from a refinery slag hearth at Newcastle, and force it through a condensing apparatus of flints kept constantly wet, 6 feet in depth. The steam jet is certainly a great and manageable power, and appears to deserve consideration, especially in mines which are ventilated by bratticed shafts, or yield enough of fire-damp to render gas drifts necessary, and the furnace action in other ways a source of anxiety. Some details on this subject will be given further on.

I will now give some numerical statements of the quantity of air circulating in one minute of time through collieries in the districts of the Tyne, Wear, and Tees; the determinations being made (with very few exceptions) by the method of powder flashing, which is the common process of the district, and, except in very low velocities, is sufficiently exact for comparative results. Let no one infer, from the inequality of the numbers, that the collieries are unequally ventilated. This cannot be known, except by taking into account the area of ground, length of course, height of seam, quality of coal, and many other circumstances which, taken together, make up the work the air has to do. These data vary extremely in different collieries, so that, in fact, some collieries with a small quantity of air are as safe as any,

and even more safe than many others with far larger quantities. The two collieries at the head of the list, for example, are, by natural conditions, relieved from almost every source of danger by explosion :—

		Cubic feet of air per minute.
1. No artificial ventilation force	Derwent Main	2,000
2. Lamp at shaft foot	Holmside	8,900
3. Furnace ventilation	Black Boy	34,000
	Belmont	44,007
	Coxlodge	20,000
	Castle Eden	42,326
	Eldon	19,179
	Felling	54,000
	Gosforth	16,000
	Haswell	100,917
	Hetton	190,000
	Hebburn	77,005
	Heugh Hall	19,200
	Holywell (East)	32,778
	Jarrow	47,952
	Murton	87,055
	Moorsley	25,000
	Mickley	12,856
	Marley Hill	26,300
	Norwood	15,750
	Percy Main	54,698
	Rainton (plain pit)	39,740
	South Hetton	45,840
	Thornley	76,331
	Tyne Main	94,310
	Wallsend	121,360
	Walker	44,800
	Willington	66,500
	West Auckland	14,478
	West Hetton	15,300
	Wingate Grange	44,000
	Wearmouth	70,500
4. Steam jet ventilation	Seaton Delaval	82,320

COMPARISON OF THE QUANTITY OF AIR WHICH CIRCULATES IN COLLIERIES, WITH THE WEIGHT OF COAL CONSUMED IN GENERATING THE CURRENT.

Colliery.	Weight of coal in 24 hours, in tons.	Cubic feet of air per minute.
Black Boy	2.0	34,000
Castle Eden	2.25	42,326
Felling	3.6	54,000
Coxlodge	1.3	20,000
Percy Main	3.45	54,698
Thornley	4.8	76,331
Wallsend	4.45	121,360
Walker	1.488	44,800
Willington	3.5	66,500
Wingate Grange	2.8	44,000
Average	1	= 18,831

In the above list no examples are included of collieries which

have underground-engines at work. In the three following collieries such engines are at work:—

Colliery.	Tons of coal per 24 hours.	Cubic feet of air per minute.
Haswell	4, beside engine-fire	100,917
Hetton	9, beside engine-fire	190,000
Murton and South Hetton	$8\frac{1}{4}$, beside engine-fire	132,895

From an attentive consideration of the data in my possession, it appears that, allowance being made for unequal lengths of air-course, and other inequalities, there is an approach to a simple fundamental relation between the quantity of coal burnt in the furnace and the quantity of air passing up the shaft. This relation is of a compound kind; the air ascends an upcast shaft because it is heated by the burning of the coal, and the draft of the heated shaft causes the fire to burn strongly. When these reciprocal actions have reached the maximum in a given shaft, no more coal can be burnt in a minute, no more air can be drawn through the mine in a minute, and no higher ventilation power can be had in that mine, unless some change be made in the furnace, or the air-channels, or workings, or the state of the atmosphere.

The largest quantity of air made to circulate through any colliery in the United Kingdom, by the action of one heated upcast shaft, is at Hetton; viz., 190,000 cubic feet in one minute (1849–50).

The swiftest current of air in a heated upcast shaft is at Haswell; the velocity being 1,740 feet in a minute in a shaft of 9 feet diameter, reduced by the timbering and fire-brick to a clear area for air of 58 square feet (1849).

The swiftest main current yet measured underground is at Wallsend Colliery, viz., 21 feet in a second, or 14 miles an hour; this single stream of air yielding 75,000 cubic feet in a minute (1849).

The largest upcast shaft is at Murton Colliery; viz., 18 to 16 feet in diameter.

The average temperature of the hottest upcast shafts in the districts of Northumberland and Durham does not exceed 170°; Marley Hill, 168°; Haswell, 165°–146°; Tyne Main, 160°; Hetton, 145°. The average length of underground air-courses in the great collieries does not now amount to 3 miles.

Great as appears the quantity of air passing through the northern collieries, it is really small as compared to the total force employed on the air current. The furnace-power, as measured by the consumption of coal, by the heat imparted to the upcast shaft, or the pressure on the separation-doors, is equal to the production of currents three, four, or more times as swift; but much of this power is consumed in overcoming the resistances on the path of the air. The circumstances which occasion

this great loss of power are nearly all referable to peculiarities of the air-channels, none of which are removable, but all capable of modification; that is to say, of being made better or worse, and therefore in some degree under useful control.

1. The length of the air-channels.
2. Their smallness.
3. The bends and angles, risings and fallings, inequalities and asperities of all kinds which characterize the underground passages.

The effect of each of these is similar, viz., friction; that is to say, destruction of the moving force by quantities directly proportional to the length of the channels, the number of their flexures, &c., and inversely proportional to their diameter.

I have arranged formulæ, and entered into arithmetical computations, to discover the exact effect of these circumstances on ventilation, so as to prepare practical rules by which to direct improvements in the many cases which need it. It is desirable that these should be made complete before communicating any of the results. Besides the circumstances already mentioned, some importance is to be attributed to the number, dimensions, and depths of shafts, thickness of seams, influence of season, leakage in the channels, and other matters which vary much in different collieries. But I have the less hesitation in asking leave to reserve my statements on these points, because, practically, it is generally true that more air can be made to pass through a mine by enlarging the furnace, shortening the air-courses, and augmenting the sectional area of the passages—measures which, in general, present no such difficulty to skilful managers, as to prevent a colliery from having a sufficient supply of air.

VENTILATION BY STEAM JETS.

The cases in which steam jets have been used in the northern coal district, unaided by the ordinary furnaces, have been few, and some of the experiments ceased before my survey was commenced. They were succeeded by a mixed class of experiments in which the steam-power was variously associated or alternated with ordinary furnace action. At present there is one colliery ventilated by the jets from an underground engine-boiler, viz., Seaton Delaval, which I have examined through the kindness of Mr. Forster. At Belmont, Mr. Elliott was so good as to repeat for my instruction some experiments by which the effect of steam jets was compared with furnace action, and with the flow of steam from the exhausting pipe. Mr. N. Wood and Mr. Sinclair have given me further information; and Mr. M. W. Robson has furnished notes of experiments on the steam jet at Castle Eden.

The following is a general view of the data thus obtained:—

Seaton Delaval .	By the steam jets and boiler fires of an underground engine .	74,391 79,359 77,455 85,690 82,320	Cubic feet of air per minute according to several measures.
	Previously by furnace action .	48,760	Ditto ditto
		53,058	Ditto ditto
Moorsley .	By the furnace alone . .	25,000	Cubic feet.
	By jets alone . . .	22,000	Ditto
	By both together . .	31,000	Ditto
Norwood .	By the furnace alone estimated	15,750	Ditto
	By the jets at the base of a staple . . .	31,500	Ditto
	By the jets at the top of the staple covered in . .	15,750	Ditto
Belmont .	By the furnace alone . .	44,007	Ditto
	27 jets, without furnace .	59,956	Ditto
	Engine at rest, without furnace	47,757	Ditto
	27 jets, with furnace . .	71,895	Ditto
	Engine at rest, with furnace .	62,652	Ditto
	Engine exhausting out of 6-inch pipe, without furnace .	56,294	Ditto
Castle Eden .	By the furnace alone . .	42,670	Ditto
	By the furnace, aided by 42 jets, the steam taken down from bank 62 fathoms .	46,706	Ditto
	By the heat of shaft only, the furnace and jets ceasing to act	30,307	Ditto
	By the steam jets alone .	35,622	Ditto

DISCIPLINE OF THE MINE.

A good plan of works, with adequate ventilation power, will not insure safety in a colliery unless there be a vigilant administration, due subordination of authority, constant inspection, and effective discipline. It is not too much to say that the daily work of a colliery should be conducted on the supposition that danger is always to be looked for and always to be provided against. It is necessary to suppose that extraordinary circumstances may arise to baffle the prudent, and that error or folly may create danger out of ordinary daily occurrences. Accidents must in the first instance be guarded against; prevented if possible, but if they should occur, the means of lessening their calamitous effect should have been provided, or should be ready.

The established discipline of a Newcastle mine contains much that is worthy of imitation. I have found no colliery without regular maps showing the extent and progress of the workings, the courses of the air, and the lines of dislocation. These maps were in most cases completed and brought up to the actual state of working at regular periods. The scale is usually two chains to one inch, but sometimes three or four chains were preferred. Sections are generally found drawn and written out. Frequently large drawings, extremely well executed, of furnaces, shafts and engineering arrangements; measures of the air currents; notes

of the consumption of coal in engine fires, and furnace fires; records of the temperature of the mine, of the upcast and downcast shafts; memoranda of remarkable eruptions of gas, feeders of water, and other circumstances of interest.

The actual condition of the mine, at any moment, is thus known to the principal or consulting viewer, as well as to the resident viewer, who is familiar by daily visits with every part of the works, and is personally acquainted with the workmen. The overman and master wastemen, who are the principal agents of the resident viewer, and have much authority in the mine, are generally well acquainted with the plans.

The under viewer has the general charge of the mining operations. He is expected to examine the mine every day, and in addition to his own personal inspection of the workings, the waste, the state of the air-courses, and the quantity of air passing in the different currents, the ventilation and the state of the mine generally, he is to receive a daily report from the overmen and master wastemen on the workings and operations under their charge. In consequence of his own observations, and these reports, he is to take measures for correcting irregularities, and obviating all discoverable sources of danger. From time to time he is to report to the viewer, and, in cases of emergency, immediately.

The overmen have the charge of the working of the pit, and of the safety of the workmen. They are assisted by deputy overmen, and their first duty is to go into the pit every morning one hour before the hewers, and examine every working place in the pit, to ascertain that it is in a safe working condition. They then return to the cabin, examine the lamps and lock them. No hewer is allowed to enter his usual working place until it has been examined by the deputy overmen stationed at his district, and during the whole time the hewers are at work, there is at least one deputy in each shift at every district of the mine. The deputy overmen lay the tramways, secure the workings by timber, see to the doors and brattices, and keep the working places right. The overmen attend to the lighting of the pit, inspect the lamps, direct whether candles or lamps shall be used in exploring drifts, or whole working. (Lamps are always used in pillar working.)

If gas is seen in any of the whole places, lamps are given to the hewers. When any working place is discovered to be foul, by any one of the officers in charge, he immediately bars it off (sets a prop in the middle of the way), as a signal of danger, so as to prevent any one from inadvertently going into it; he then takes measures to "clean" it, by bratticing close up to the face, which seldom fails to render it in a short time fit for the hewer to enter.

Should any working place become suddenly foul and dan-

gerous to work in with a naked candle, the hewer must retire; he must inform the officer in charge, and then, if allowed by the officer, he may resume his employment with a safety lamp; if not, he must cease working. Lamps are not to be allowed to burn when the gas fires within them. They are to be extinguished, and the workmen must retire and inform the overman. The deputies, at the close of each day's work, are to see all the men and boys out of their respective places of work, that no lights are left in the pit, that the doors are closed, and the ventilation is in good order. On Sunday mornings and on days when the pit is not worked, the overmen go round to examine into the ventilation, and the state of the pit.

The master wasteman with his assistants travels daily in the waste or old workings; sees that the air-courses are everywhere in good order; remedies falls of the roof; builds or packs up where necessary; removes impediments to the movement of air; and attends to keep the ventilation good generally. Two travelling together, the wastemen go over the whole of the waste, at least once in a week. They attend to the clearing of the furnace drift.

To a certain extent the men employed in the pits are expected to assist in these arrangements, by judging of their own safety, and acting accordingly; they are to complain of insufficient timbering, bad air, &c.; and in case of a strong impression of danger in their minds, they are allowed to demand a view by some professional man unconnected with the colliery. In particular collieries, the workmen are allowed to appoint a number of themselves, not exceeding six nor less than three persons, to examine, at any convenient times, the workings of the colliery. If, while working, danger comes upon a man, he is expected to retire and give notice to the officer in charge of his portion of the pit. The men take home the tops of their lamps, clean the gauze, and bring it back to be screwed to the oil cistern and locked at the cabin.

In Percy-Main Colliery, a reward of 5*s.* quarterly is given to the hewer, and of 2*s.* 6*d.* to the putter, who keeps the cleanest lamp. Fines are imposed for mismanaging the lamp, smoking tobacco underground, taking candles beyond the station, leaving a lighted candle, taking in lucifer matches. Swearing, quarrelling, &c., are prohibited, and fined. The amount thus levied in fines, is applied, at the discretion of the mine managers, to reward good conduct, support institutions useful to the men, poor families of workmen, or charitable establishments.

In case of accidents heavy expenses fall upon the owners. Not only are often pensions bestowed on the surviving widows and children of persons killed by explosion, choke-damp, or fall of roof; but in less important cases, shaft accidents, burnings, and other injuries, there are considerable and sometimes long

continued payments for medical attendance and subsistence. It is beyond question that to free a colliery from accident is very effectual economy; to allow a colliery to fall into discredit for ventilation, general safety, and comfort, is a folly no less costly than reprehensible.

The duties of the officers and men, in particular the rules respecting safety-lamps, are commonly printed for general information; they are in fact almost known by heart.

ART. V.—GENERAL OBSERVATIONS ON THE FORMATION OF METALLIFEROUS VEINS.—BY B. COTTA, PROFESSOR AT FREIBERG, GERMANY.*

THE formation of metalliferous veins should not by any means be considered as an isolated occurrence or independent subject for contemplation. It must be regarded as existing in the most intimate connection with the formation or alteration of certain rocks, as it is only a peculiar effect of particular geological operations, if by this latter term we may designate the vast changes that have taken place on the surface of our globe.

At the time of the early investigations in the field of special geology, and when the general and vague hypothesis of the formation of our planet—such a favorite topic in the last century—had been abandoned for the observation of more distinct geological phenomena, it was a common error to consider these as separate and not necessarily dependent upon others. It was then customary to apply the explanation, arrived at for the peculiar case, to every other which might chance to evince some analogous symptoms. An excessive and marked individualism on the one hand, and on the other an equally unjustifiable generalization, was the result. It was considered proper to explain the formation of all metalliferous veins in the same manner as the origin of one particular case was proved to have been, regardless of its peculiar occurrence and the adjoining formations. Even some of our recent and most important writers have allowed themselves to be carried away in the same manner. It would almost seem as if they had forgotten that the terms *vein* and *lode* merely designate the form of occurrence, but by no means its nature; and that ores of various kinds (native metals, sulphurets, peroxides, protoxides, and hydrates) are found in veins in different combinations and under manifold circumstances.

Another error of early geologists was to regard geological operations as something quite distinct, and belonging entirely to a pre-Adamite world. This view was calculated to favor the

* Translated by Oscar M. Lieber.

more daring and groundless hypotheses. To the mind of the geologist of those days nothing appeared impossible. They paid no attention to the analogies of precedents, and, in fact, scarcely even allowed for the laws of nature. It was particularly Sir Charles Lyell to whom the merit is due of having successfully combatted this procedure. He showed that the grandeur of results is vastly increased by the duration of causes, and that it is not necessary to adopt theories of extinct causes for the formation of the crust of our globe. According to Sir Charles, the operations still in progress were sufficient, in the process of time, to produce the present appearance of the surface of the earth. Nevertheless, it is evident that he and his followers have fallen into the extreme of not allowing for any developing process of our planet, but merely admitting a continued change, while innumerable facts go to prove a process of development, produced by the progressive cooling of our sphere. I need but point to the marked difference, in composition as well as form, of the old and new volcanic rocks, and to the organic development perceptible in fossil remains. This progression necessarily leads us in its convergency to a zero, in which no organized beings inhabited the earth.

The theory of the development of our planet by cooling is supported by numerous facts, and suffices as a general rule to explain the mass of geological phenomena, and the formation of the earth's crust, although many particulars may, for the present, be hidden from our view.

It shall be my endeavor to give a general view of the particular formation of veins, presupposing the adoption of the above-explained main formation of the solid crust of the earth. Such a combination must remain for the present a matter of faith; but we are unable, even in science, entirely to dismiss belief and opinion as preceding certain knowledge. If it is based upon facts or sensible foundations—that is, if it is a reasonable opinion, fully aware of its causes—and if we always remember what portion is purely hypothetical, no evil can result. On the contrary, theories are ever productive of good results, if we do not forget ourselves and follow them up blindly; for they create a desire to discover foundations, and hence induce investigations to be made in particular directions.

It is my desire to point out the general geological characters of metalliferous veins without particular reference to their circumjacent rocks. As a general rule, it is necessary to regard these as already determined and established, and in a few instances only will it be necessary to call more particular attention to them.

With the exception of some ores, which are almost entirely those of iron, we can only expect to find their veins traversing the older rocks. Most commonly they occur in the crystalline

schists (the metamorphic rocks, as gneiss, mica, slate, etc.); in the more ancient igneous rocks,* as granite, syenite, greenstone, porphyry, etc.; in the graywacke rocks, and as late as the magnesian limestone (the zechstein of the Germans). They are of much rarer occurrence in the more recent stratified deposits. Exceptions are found at Milhau, in Southern France;† in the upper new red sandstone (the mushelkalk) and lias, in Chili‡ and Algiers,§ and in portions of the cretaceous group. They are equally seldom found in trachitic, basaltic, and phonolithic rocks.

They exist, like the ancient crystalline unstratified rocks, for the most part in mountains, and not on plains, and very frequently occur in conjunction with those rocks (granite, greenstone, porphyry, etc.)—that is to say, near them, or frequently also traversing them.

These general facts point out a certain connection between the older volcanic rocks and veins of metalliferous rocks, which Fournet has endeavored to prove more especially in a separate treatise. The probability of this co-ordination is increased by the fact that, at least in Germany, the relative age of these volcanic rocks coincides with that of the veins; that is to say, they both belong to one great geological period. Generally, too, they only penetrate the stratified deposits up to the magnesian limestone, into which, it is true, the metalliferous veins have pierced farther than the granites, porphyries, and greenstones.

If we examine these ancient crystalline rocks with more minute attention, it is soon discovered that they very often contain the constituents of the veins as accessory admixtures, or that, in their component parts, these latter are found chemically combined. Commonly, the per centage of metal increases as the bulk with which they appear at the surface diminishes. Where they appear in great masses, most of them are generally very free from metallic admixtures, and at their margins, or in the smaller leaders and droppers which diverge horizontally or perpendicularly from the main body, these are principally contained. As illustrative of this fact, I shall point to the tin mines of Altenberg, Zinnwald, Geier, the ore-bearing greenstones of Schwartzenberg, and to various magnetic iron-ore localities and ore-bear-

* Some geologists may object to the term of *ancient volcanic rocks* having been preferred to the older designation of *plutonic rocks*. The translator has adopted this term, however, as the origin and formation of the two must be the same, and as there is no difference, apart from composition, except age and bulk. The German term is *eruptiogebilde*, which, like *igneous*, is certainly equally applicable to both.—O. M. L.

† *Fournet*, On Veins of Ore.

‡ *Erdmann's* Journal (Germ.) 1843, p. 33. *Doureyko* in the Ann. d. Mines, IV. 9, 1.

§ Jahrbuch (Germ.) 1845, p. 114, and 1847, p. 237.

ing porphyritic dikes. It would appear even as if the most external crust of the massive rock were more metalliferous than the portions beneath it; and it is probable that the destruction of a crust of this kind may have been the cause that localities, formerly regarded as sufficiently rich for mining operations, it has now become necessary to abandon, as scarcely a trace of the metal is now observable in the rock. As an example, the tin mines in the granite regions near Weissenstadt, in the Fichtelgebirge of Germany, may be mentioned.

Should we not, under these circumstances, suppose that the main rock itself was originally the repository of the ore contained in the veins? It is a view which agrees perfectly with the theory of the congealing of our planet. It is true that, for the present, this can only be regarded as a mere hypothesis. Nevertheless, let us adopt it, and endeavor to build upon it, and by its means to explain the various established facts. As a matter of course, it is necessary that, as with every hypothesis, we should take great care not to regard the facts, which we know as such, as a secondary consideration, but, on the contrary, make the hypothesis agree with those facts, and to drop it as soon as we discover that it is incapable of doing so.

Let us, therefore, consider the component parts of the metalliferous veins as having been originally distributed in the crystalline mass of rock; that is to say, in the igneous* and fluid interior† of the globe, and thus proceed to discover whether or not we can, according to known facts, adopt this supposition. There, where the main rocks are exposed in great bulk, they cooled but very gradually, with the exception of the extreme margins and the superficial crust. The result was, that those metallic particles, chemically uncombined, and which were heavier and more easily molten, compared with the rest of the rock, had time to sink very much, as it is the case in our furnaces; and this may be the reason why very massive igneous rocks are sometimes only productive of metals at their rapidly-congealed margins and surfaces. The same may be said of the more diminutive branch veins, which, rapidly discharging their caloric, prevented the metallic particles from settling. They congealed together, with the rock of the gangue; and a similar view may be taken of those lodes, which we must consider as having originated from the fused lower portions having been forced up into those above, which were already congealed. In fact, generally speaking, the veins of granite, in granite, syenite, and granulite, contain more metallic parts, particularly magnetic iron ore and iron pyrites, than the great bulk through which they have been injected. In this case it is pretty much the same,

* The German is "*eruptivgeworden*," having become eruptive or volcanic.
† "*Erdkern*," kernel of the earth.

whether they merely penetrated the congealed surface of the mother rock, or also the neighboring portions; only, that in the latter case, the cooling in all probability took place more rapidly.

The smaller masses, or veins of granitic rocks, are particularly worthy of note as being tin-bearing. The tin ore, together with its usual companion, tungsten, is found partly in the body of the lode in minutely distributed particles, partly in the small, net-like gashes, which were probably formed by the cooling of the mass before the whole of it had become solid. Quartz, chlorite, mica, and tourmaline, have separated themselves, together with these ores, in a crystalline form; and if these little veins also contain galena, apatite, blende, or asphaltum, fluor spar, spathose iron ore, arragonite, or a secondary deposit of quartz, tungstate of lime, or salts of lead, then it is evident that these have been added later, either by sublimation or infiltration, or else by partial conversion of already existing ingredients. If, however, the deeper regions of these particularly metalliferous lodes—in which, notwithstanding the velocity with which the surface became congealed, more metallic particles have collected than are perceptible at the surface, and which, on account of the ease with which they melt, remained longer in a fluid state—were again made igneous or volcanic; that is to say, were forced up anew into the fissures or crevices of the recently consolidated lode, or of the neighboring rock, they may have formed such tin-bearing veins as are worked, for instance, at Ehrenfriedersdorf, in Saxony, in and near the main body of the lode.

We thus discover, with but one principal original cause—the injection of a crystalline rock—four or five different means of filling up the cracks and fissures of the veins, segregation from the still uncongealed neighboring rock, sublimation, infiltration, alteration, and injection in the fluid state. Sometimes several of these occurrences are perceptible in one and the same vein.

Very similar to the tin-bearing granites are the metalliferous greenstones of Schwartzenberg, in Saxony. They differ, however, in the fact of being more narrow, and usually forced into the fissures parallel to the slaty structure of the surrounding rock, therefore much resembling layers or strata. The consequence is, that they are commonly richer. I believe that I have sufficiently proved their volcanic, injective origin in 1833.* With these also the processes of sublimation, infiltration, and the productions of chemical changes, have added to that which was originally forced into the crevices; and if in such localities equally small greenstone dikes, containing no metal, are found, it should never be forgotten that the circumstances which at-

* The author here alludes to his explanations of the geological map of Saxony, vol. ii. p. 217–246, q. v.

tended their formation and consolidation may have been very different.

It is peculiarly characteristic of these plutonic injection, or secretion veins, that the gangue rock does not contain carbonic, fluor, or heavy spars, but amphybole, pyroxeus, garnet, quartz, mica, and felspar; therefore, such minerals which also occur as ingredients of the adjacent rocks.

The porphyritic veins, also in the vicinity of Freiberg, frequently contain ores. In one of these dikes, which crosses near the Mulden furnace, iron pyrites occur in considerable quantity; and at a new quarry, opposite the upper works, many cracks and fissures in the porphyry are lined with pyrites, sulphuret of lead, zinc blende, calcspar and heavy spar. These same minerals do not only present themselves in the constantly recurring wedge-shaped strings of the main dike, but also in thoroughly encompassed pockets, showing themselves therefore to be intimately connected with the porphyritic rock. In the same manner are the porphyry dikes of Nonneuwald and Fuerstenwald, near Little Waltersdorf, traversed by many ore-bearing quartz veins.

At Huette, a few miles from Freiberg in Saxony, we find, at the margin of the porphyry country of Tharand, and in an isolated dike of the same rock, the cavities filled with galena, zinc blende, and sulphuret of iron; and, according to some, not however quite authentic, investigations, it is said that some of these porphyries contain even auriferous sulphurets. The most important occurrences for our views are the ore-bearing porphyroid rocks in the neighborhood of Braeunsdorf, a village near Freiberg, which Mr. Mueller has particularly investigated and described.*

It seems to be a matter which certainly calls for our most especial consideration, that in the igneous porphyroid formations of the neighborhood of Freiberg, the same ores and minerals are found disseminated through them which occur in the regular lodes of that country. It is true that these latter are, as a rule, of a later origin than the porphyries which they continually traverse; but Mr. Mueller has proved, that in the Emanuel mine, the most ancient lodes of the Freiberg mining country, those whose rock is quartz, have been penetrated and disturbed by certain porphyries, and that, therefore, both the regular lodes and the porphyries belong to one geological period; and, in fact, that the filling up of the cavities containing the lodes is referable to the porphyry eruptions.

A new matter of experience or supposition can never be sustained by too many single facts, and, therefore, I shall here

* The communication of Mr. Mueller may be found in Cotta's Studies on Ore Veins, Freiberg, 1850, from which this is translated.

remark, that the delomic limestone, which lies in the oldest clay-slate near Tharand, just there where it comes in contact with the porphyry, very often contains, in rugs or druses, the crystals of iron and copper pyrites, galena, zinc blende, and heavy spar. Would it not be just to suppose that these minerals are here as well caused by the neighborhood of the porphyry as in the Freiberg mines?

[To be continued.]

Art. VI.—AMERICAN GEOLOGY.*

AMERICAN Geology, as such, has hitherto had no exponent, unless it is to be found in the work whose title is placed below. That it is there investigated, it will not be necessary for the reader to enter far in its pages to satisfy himself, or to become convinced that he has in his hands an able work containing novel views of a new subject, or perhaps it would be more proper to say, new and independent views of a great subject. The author writes like an able and independent thinker, fearless in expressing his views from a consciousness of innate ability to maintain them. He asks not for authorities, but seeks facts. He leans upon no theories, nor fortifies himself with any opinions unless they are sustained by the senses. It is this method of entering upon the investigation of American Geology, this disregard of anything like aristocracy in science, which we like, and the result is that we have a more clear and satisfactory statement of the principles of this science in the abstract, together with an exposition of it, than is to be found in any other of the numerous volumes issued from the press.

The work itself, of which the first part has just been issued, is published in a style unequalled by any scientific American work. The paper is no whit inferior to the best style of European books, and the execution is worthy of it.—The embellishments or illustrations, which have been executed on wood, stone, and steel, are among the very best of their kind. It truly affords a pleasing satisfaction to see that the value of such a style of publication is appreciated, and to know that the public taste of the day has compelled publishers very extensively to resort to the best skill and materials of their trade.

This undertaking is introduced to the public not with any extensive or explanatory preface, by way of an apology for

* American Geology, containing a statement of the principles of the science, with full illustrations of the characteristic American fossils. To be published in four parts, with an Atlas and a Geological Map of the United States. Ebenezer Emmons. Part I. 8vo. pp. 194. Albany: Gray & Sprague, and J. Munsell.

doing what should always be fearlessly done, but with a few sentences, modestly entitled, "Proposals," which are briefly as follows:—

"The American Geology will be published in four or five parts, each of which will be illustrated by appropriate wood-cuts. Each part will contain about two hundred pages of letter-press. The paper and press-work of the present part shows what the mechanical execution will be.

"The fossils will be executed on stone and steel by the best artists, and no expense will be spared to make the work complete. The present part, it will be observed, contains a fine illustration of the moon's surface, on stone, by Swinton, and a quarto plate, on steel, by our distinguished engraver, J. E. Gavit. The plates of fossils will be distributed with each part, but numbered for binding together in a uniform style with the geological map when the work is complete.

"I have no design to find fault with or disparage the works that have been published by our geologists, still it cannot fail to be observed that they are not American. We want an American Geology, and all necessary means will be employed to accomplish the purpose I have proposed.

"E. E."

The preliminary remarks with which the work commences are devoted strictly to the science of geology, and notice such points as are necessary to be understood, as lying at its base, and as exerting an influence throughout all its investigations. This is a part of a scientific method, and, likewise, indispensable for those less familiar with the general subject, at the same time it affords the ground for the distinctive features of every treatise. There may be many who will dissent from some positions of the author, but we doubt if they can combat them with better sense or more forcible logic. Take the doctrine of progressive development for instance:—

The life of plants and animals is controlled by a single element; that is, oxygen. The adaptation of organs is in accordance with its properties. It has always been so. We presume, too, that its supply has been constant—that there has been no period when its quantity was either greater or less than it is now. A different view is not sustained by the fact that at one period huge lizards predominated in its fauna, for analogy proves that this class would have perished with a less proportion than that which exists in our atmosphere at the present time.

In cases of this kind, reasoning from special structural affinities to general physical conditions is not always safe. The lias and oolitic periods abound in the remains of cold-blooded animals, whose respiratory apparatus was undoubtedly imperfect, like the lizards of the present. It is a favorite inference with a certain class of the progressive geologists, that the oxygen of the atmosphere at that period was less in proportion to its mass than it is now. But then may we not inquire, if there was less oxygen in the present atmosphere than there actually is, could the menbranous reptile lung supply the demands of the system; and is not the constituent proportion of oxygen the

quantity required to give the creature the power to breathe at all? I say it is not always safe to reason from structural affinity to physical conditions. If we take any other organ, as the eye, and draw from its structure and condition analogous inferences concerning the quantity of light, we may see where it will lead us. A class of progressive geologists, maintaining that in the early periods of life the light of the globe was dim, and that but few rays shone through the hazy atmosphere, find in support of this doctrine the fossil remains of a fish or a lizard with enormous eye sockets. He believes that the large eye was adapted to a dim state of the atmosphere. Another person finds a fossil with very small bony sockets. In this case, too, it may be said the eye was very small, and hence it was adapted to an exceeding intense light—to the sun when it shone fiercely from its throne in the heavens. But again, a fossil is found entirely destitute of an eye socket, and not a vestige of an organ of vision can be found; hence, there was a time when the earth was shrouded in darkness, for in darkness animals have no need of eyes, and light would be useless to animals destitute of the visual organ. But then we find all these states of the eye in the present arrangements for supplying the world with light. The Pomatomus telescopium, a fish of the Mediterranean, which lives in very deep water, has a remarkably large eye. It is the position which it occupies that requires the large eye, and that large eye is adapted to its abode; and if only one-half of the light of the sun was extinguished, it probably would be unable to see at all. And just so with the reptile, if one-half of the oxygen of the atmosphere was withdrawn from it, all reptiles would die. The mole has a very small eye, but that small eye would be of no use if the ground was lighted by fewer rays. The blind fish and the blind animal of the mammoth cave live in a period when the earth is lighted up most gloriously: their abodes are dark, but yet the sun shines without in all its strength. We find, then, all conditions of the eye and the lungs at the present time. But it does not follow, that because the structure of the fossils of a given period may be found whose organs belong to a certain type, that the physical conditions of the earth were materially different from what they are now. This view of the subject does not conflict with the doctrine of adaptation, but rather sustains it. The physical conditions are first established; the organic kingdoms afterwards come in with their separate adaptations. The organisms are perfect in their adaptation to the conditions in which they are to live, as well as to the position in space, and the mediums in which they are to be placed. The doctrine of progressive development, as usually represented, seems to be untrue. It proceeds on the ground that the earliest beings were the least perfect, and that progression consisted in the creation of those animals which were more perfect in their structures than their predecessors. But who cannot see that the world is full of the same imperfections in animals now as in the beginning. Progression has no reference to perfection of structure, but to rank. Structures have been always perfect, but rank has been progressive.

The nomenclature adopted in this work contains some decided improvements; there is, however, room for more, which we hope to see at some day introduced. As here presented, it is clear and comprehensive. The rocks called *metamorphic* or *azoic* are not recognized as classes, or even subdivisions of sections, inasmuch as they have no special peculiarities which make them applicable for such purposes. Metamorphism occurs, or may occur, in all the series of rocks from the earliest to the latest sediments. It is true that the term metamorphic has been confined to gneiss, mica slate, hornblende, talcose slate, &c.; but its use is theoretical, and was thus applied on the hypothesis that

those rocks are altered sediments, of which there is no evidence. The term *azoic* presupposes that our observations have made certain that which from the nature of our evidence must ever remain doubtful. There is no doubt but that granite gneiss, mica slate, &c., are azoic, but no one would think it proper to apply it to those rocks. The following is the nomenclature adopted:—

CLASSIFICATION.

		Stratified.
III. Hydroplastic, ...	c. *Kainozoic*, ...	Alluvial and drift, Pleistocene, Pliocene, Meiocene, Eocene.
	b. *Mesozoic*, ...	Cretaceous, Lias and Oolite, Trias.
	a. *Palæozoic*, ...	Permian, Carboniferous, Devonian, Silurian, Taconic.
II. Pyroplastic, ...	b. *Sub ærial*, ...	Lavas, Tufa, or Volcanic Products.
	a. *Sub marine*, ..	Greenstone, Porphyry, Basalt, Trap.
I. Pyrocrystalline, .	b. *Laminated*, ..	Gneiss, Mica, Slate, Hornblende, Talcose Slate, etc. Laminated Limestone, Laminated Serpentine.
	a. *Massive*, ...	Granite Sienite, Hypenthene Rock, Pyrocrystalline, Limestone, Serpentine Rensselaerite, Octahedral Iron Ore.

The remainder of Part I. is devoted to descriptions of the rocks, commencing with the Pyrocrystalline, and closing with the Pyroplastic, as they are developed in this country. There are many interesting points here, to which we would like to bestow, at least, a passing notice, but must refer the reader to the work itself, with accompanying illustrations. The latter portion of this Part is devoted to the subject of mining, &c., embracing nearly sixty pages, and to this portion we shall confine our further remarks.

The term "mining," in the comprehensive sense here used, is treated of under the following heads.

1. The theory of the formation of those depositories which contain the metals and ores.
2. The structure of those depositories.
3. The changes which the mineral undergoes in depth.
4. The best modes for extracting their metals and ores, including those which have been devised for raising blocks of rock from their beds.

5. The expense attendant upon different kinds of work in mining and quarrying.

6. The value of the products of mining.

In the explanation of the theory of the formation of those depositories which contain ores, there is much which is of interest, of which, however, we can only take a passage or two:—

In the first place, we must look upon all the repositories of the ores and metals as ancient arrangements, by which they are made accessible to us; and that those arrangements are the necessary result of the constitution of the globe. They are by no means to be regarded as accidents, arising from conditions which might have been otherwise. They, too, are general results, confined to no limited scale; and when the forces and plan were determined, upon which to form and fashion the earth, the results of which I have spoken became an essential part of those causes, and it would have required special instrumentalities to have prevented their operation just as we now see them to have operated. It is for this reason that the formation of repositories for the metals has been controlled by law, by which certain constants may always be looked for. This being the case, the miner has not overlooked the plainest of these results, but is constantly referring to them in his operations with confidence.

It is not necessary that we should connect these laws with the early conditions of the globe in order to understand them; but as facts it is proper that they should be borne in mind. What was that original condition, then, which gave birth to the repositories of the metals? It was that incandescent state of the crust of the globe, of which I have already had occasion to speak. We have no occasion now to inquire what gave birth to that incandescent state; the fact is attested in the phenomena everywhere visible in those portions of the earth's crust which belong to its earliest epoch. The most important effect of this state is the expansion of the crust, or the occupation of a larger space for the time being. But the earth, situated in space, and in a colder medium than itself, has necessarily lost that primitive heat which belonged to its earlier stage of existence. It has cooled, and the most important result which interests mining is the consequent contraction of the cooled part. Contraction has severed the bonds of the continuity of the strata; and those fractures which are the result of the cooling process have been made in comparatively straight lines, or in given directions; or we may regard the causes of fractures simply as subterranean, but due to general conditions, and which must necessarily affect the whole of the cooling envelope.

The fact that fissures may be, and probably are thus formed, is agreeable to all that is known of cooling bodies; and observation which has been directed to those fissures proves, in the general at least, that the fissures are made in lines of bearing quite constant. We may not infer that a mechanical force is applied beneath a stratum, and has erupted those strata in the lines I have spoken, as a previous step in the formation of a vein. A cooling state has given rise to a state of tension, which increases in the direct ratio of the diminution of temperature, which is finally too great to be borne, when the continuity is broken. It is true that a subterranean force is often operative in the mode represented, and by which strata are uplifted and fractured; but it is more consonant to facts to suppose that vein fissures are the result of cooling and the great tension which arises therefrom. As a general rule, the direction which a fissure has taken was in a line of the weakest part of the stratum; but it is easy to conceive that a greater strain may be made upon a stronger part, so as to form a fracture in a line which is apparently along the strongest part of the stratum. In crystalline rocks the planes of lamination must be regarded as weaker planes, and hence it is that a very large proportion of our veins of magnetic iron lie along those planes.

The continuity and persistence of veins is an important subject to the miner, relative to which our author says:—

The expenditure of capital in mining is warranted only where there is a good degree of assurance of the persistence of the vein in a downward direction. While it must be admitted that each particular case should have its own evidence of its continuity, still that evidence is based on general facts and principles. We refer in the first place to the theoretical views we have offered relative to the origin and formation of veins. If that theory is sustained by observation, we are carried a great way towards a satisfactory establishment of a persistence of veins in a downward direction, subject, however, to an interruption, it may be by the operation of local causes, which may have deranged or interrupted the formation of the vein fissure. We may not, however, neglect the teaching of facts as they are being furnished by the workings of the oldest mines. To the mining records of other countries, where it has been the business for centuries, we may refer with great satisfaction. The veins in the mining district of Cornwall, England, have been pursued successfully to the depth of 1,800 feet. It was thought by one class of geologists that they had become less rich at the depth of 600 to 1,200 feet; still they appear to retain their richness to-day, with very little or no abatement, to the depth of nearly 2,000 feet. There are still deeper mines in the districts of the Hartz mountains. Those of Clausthal and Zellerthal have been pursued to the depth of 1,920 feet. Those in the district of Andreasberg, 2,400 feet. In the neighborhood of Freiberg, Saxony, the mines have been worked to the depth of 1,800 feet. The Mexican silver mines have been explored to the depth of 1,500 or 1,600 feet; and the quicksilver mines of Almaden, in Spain, have sustained their richness beyond the depth of 900 feet.

The continuity of veins in the direction of their strike has not been determined with exactitude. Some of the veins of Freiberg are known to extend in length from 12,000 to 24,000 feet. Another is known to extend 36,000. But in the direction of their strike or bearing, there is a great variation in their condition. An auriferous vein of quartz in Maryland, extended only twenty or twenty-four feet in its line of bearing, plunging down at each extremity on a rapid slope; and yet there is little doubt that its depth continuously is as great as any of the auriferous veins of our country, whose line of bearing may be traced for one or two miles. The records of mining furnish many curious as well as interesting facts. Veins are often explored for several years without returning a compensation for the labor and expense incurred, when they are abandoned. After many years of rest, an enterprising miner or capitalist, who is acquainted with the history of its former working, having faith in its value, re-opens the mine, and pursues it with great success. Occurrences of this kind are common in all mining countries. They show, in the first place, what superior skill may accomplish; or, indeed, the subsequent success may have arisen, not so much from superior skill in working, as from having opened a richer part of the mine. All experience in mining proves that the wealth of a mine is variable; some zones are rich, while others are comparatively poor; and this fact is one which should be universally known; it is one which the capitalist should be prepared to meet in any mine, however rich it may be at certain points of exploration. This remark is applicable to veins of lead, copper, silver, and gold, rather than of iron.

The structure of mineral veins, together with the kinds of veinstone which contain the ores or metals; indications of a good or bad vein judged of by the character of its walls; changes which a vein undergoes near the surface; character of some of

the metalliferous veins of this country; limonite or hematitic ores of iron; the gold-bearing rocks of the United States; changes which take place in the auriferous veins of sulphurets of copper and iron in depth; the geological position and relation of gold; comparative richness of the upper and deeper parts of the vein; direction of the auriferous veins; age of the auriferous veins of North Carolina; age of the gold-bearing rocks of the country; distribution and extent of the auriferous rocks east of the Mississippi Valley; of the pyrites and auriferous copper lodes of the Atlantic slope. Such are the titles of many of the subjects subsequently treated of. We pass over all of them to find a place for the annexed important practical consideration:—

ON THE EXPENSES ATTENDING MINING OPERATIONS.

It is scarcely necessary to observe, that the expense of working a mine must depend upon a variety of circumstances, and that the estimate of those expenses which will probably accrue in the working of any given mine, will not be applicable to any other, though the actual amount of metal may be the same in each.

In some cases a work may be prosecuted successfully without the aid of gunpowder; in others the hardness of rock may become excessive at certain depths, and trap dikes may cut off a lode, and hence heavy expenses will be incurred in recovering it. Variability in the hardness of rocks is one of the principal causes of the difference of expense in working mines which belong to the same rock or formation.

Mining operations embrace three kinds of work—shafting, tunnelling, and stoping. Shafts are right-angular cuts into the soil and rock, in which respect they differ from wells. They may be perpendicular or inclined. They are necessarily perpendicular if the lode is vertical; they may be inclined and sink upon an inclined lode to great advantage by employing a proper apparatus for elevating the mineral. But they are more frequently vertical, and sunk at a distance from the outcrop of the vein, so as to intersect it at any given depth which may be desirable. To do this, it is necessary to ascertain in what direction and how much the vein dips, or, in other words, how many feet the vein makes on the dip side in any given number of vertical feet. Thus, a vein may make to the west seven feet horizontally in seventeen vertical feet. It is easy from these facts to calculate how far west from the outcrop the shaft must be sunk to intersect the vein at one hundred or two hundred feet; and so of any other ratio which the vertical plane may bear to the inclined one. It is to be borne in mind, that a very flat vein, as has been already observed, will become steeper as it descends. In very flat veins, therefore, calculations of this kind cannot be relied upon until the vein has reached its maximum dip.

Tunnels or drifts are horizontal cuts into the earth or rocks. They may be designed both for conveying outwards the mineral and for drainage. In that case they are made from the outside, or begin on a slope and are worked inwards, or they may proceed from a shaft to a lode which lies upon one side of it.

Stoping is a term applied to that kind of work by which the vein or its metal is removed from its bed. The most economical way is to stope from beneath upwards. The dead rock is readily disposed of, and placed so as to save the expense of raising it to the surface, and at the same time aid in supporting the walls. The arrangements for stoping should be such that several gangs of miners may be employed in taking down the vein at different levels at the same time. In this case they will be arranged generally in a series

of steps, one above another. The cost of a shaft, seven feet by five and sixty feet deep, will not be less than two dollars and a half per foot. If sunk to one hundred feet, it will not be less than four dollars per foot. A windlass will answer for the purpose of raising rock and earth for the first sixty feet, but a whimsey, or whim, is more economical below that depth. The apparatus for raising the rock and water, however, must depend very much upon circumstances. If it is a trial shaft merely, and the vein is of a doubtful character, it will not be prudent to incur the expense of a whimsey until after the vein has been proved to a certain extent.

Other expenses are incurred in mining operations before the mineral is ready for smelting besides those which attend the shafting, tunnelling, and stoping. Almost all ores require roasting in order to fit them for stamping. There are, therefore, three operations at least to which the ore must be subjected to fit it for smelting, viz.: assorting, roasting, and stamping or crushing. Passing by the expense of assorting, as this must be the most variable of the three, and cannot be calculated before trial, I proceed to state the expense of roasting and crushing a given amount of iron ore. The roasting is performed in kilns of a simple construction.

One kiln, containing 107 tons of ore, will cost:

1. For mining, fifty cents per ton,	$53.50
2. Five cords of wood, two dollars per cord,	10.00
3. Teaming one hundred rods,	11.50
4. Labor for filling the kiln,	16.00
	$91.00

In the case of iron, there is usually the expense of separating the rock from the ore, which is effected either by magnets or by washing. If the first method is adopted, the expense will amount to

1. 6 men, 2¾ days in crushing, one dollar per day,				$16.50
2. 1 engineer, 2¾ days, at $2.00 per day,				
3. 1 assistant, 1	"	1.50	"	
4. 1 machinist,	"	2.50	"	
5. 1 man,	"	1.25	"	
6. 3 men,	"	1.00	"	
7. 1 boy,	"	50	"	40.42
8. 10 cords of wood for engine,				20.00
Total cost,*				$167.92

There will also be a loss of ten tons in shrinkage, which will leave only ninety-seven tons of ore after it has passed through the several operations.

As separated ore is now selling, this will be worth	$253.00
Phosphate of lime saved, worth	125.00

The allowance for loss in separating by water is about twelve tons per one hundred.

VALUE OF THE MINING PROPERTY IN CERTAIN STATES OF THE UNION.

The country is not wanting in a class of persons who decry mining enterprises, and pronounce all attempts for developing its mineral wealth schemes more fraught with expectation than with reasonable prospects of fruition. This class, though wealthy, never invest their means or their money in mines.

There is another class who may be equally unbelieving in the real value of mineral property, yet are ready to plunge into any scheme or project in which there is enough to make a bubble—something which may be inflated into consequence. This class of men have little to lose, and being reckless in

* Sandford mine, Essex county, New York, Lot 21.

representation, are ready to avail themselves of such arts as are necessary to advance their unrighteous schemes.

There is also a third class, who look at matters in a different light. They are satisfied that there are valuable mines, and, moreover, they look at the world as progressing in the arts, and requiring every day for its progress the wealth which is concealed, except to the eye of science, in the bowels of the earth. They see that, for years to come, the increased wealth of the nation is to be drawn from this great storehouse. They are disposed to invest their money in this kind of property, and to be content with the fair gains of the business. They are aware that it is not without its risks, but to diminish them resort to all the means which may be necessary, in each particular case, to secure a successful result.

The course pursued by the second class has been so notorious as to give character to mining enterprises, and to invest them with a suspicious appearance.

I have not space, however, to follow up this subject. My principal object now is to state very briefly the value of some kinds of the mining property of our country, for the purpose of placing the subject in a prominent light, and thereby show that it is for its interest to foster and encourage all mineral enterprises which are undertaken in a proper spirit.

The time is not far distant when mining will form one of the great industrial pursuits of the country. Every blow of the pick, and every gunpowder blast, will add their farthings to the common wealth of the nation, for every pound of copper or iron is a real addition to its resources.

1. Northern New York. The net proceeds per annum, which may be realized from the ores of iron in Northern New York, will pay the interest, at seven per cent., on $3,000,000.

The mines at Adirondack have just been sold for $500,000, a sum much below their real value. The Sandford ore bed, in Essex county, cannot be estimated at much less than $500,000. At this mine, from two pits alone, twenty-one and twenty-three thousand two hundred tons of ore per day have been raised, at a cost not exceeding fifty cents per ton; and which, when crushed and separated, yields from five to fifteen tons of phosphate of lime per one hundred tons of ore, which is worth on the ground twenty dollars per ton, and twenty-five to thirty dollars in New York.

There remain the Clintonville and the Saranac iron districts, together with inexhaustible quantities of the specular ore in Jefferson and St. Lawrence counties, and the magnetic ores of the Highlands.

2. Pennsylvania furnishes an amount of iron which may be estimated at $5,000,000 annually.

3. Missouri, from the Pilot and Iron mountains, is capable of furnishing as much iron as any part of the world. Situated in the great valley of the Mississippi, its value can scarcely be overrated.

4. The iron mountains of Lake Superior are equally as rich as Northern New York. There are some, perhaps, who may regard this comparison as unjust to Lake Superior; but it must not be forgotten that one mine, the Sandford Lake mine, is between six and seven hundred feet thick. A square yard of ore weighs four tons.

5. Maryland, Virginia, and North Carolina possess inexhaustible supplies of iron ore, which are mostly the hydrous peroxides of iron. The hematites of Vermont, Eastern New York, are very extensive.

6. The brown ores of iron in the south-western counties of North Carolina, and in Eastern Tennessee, are immense.

A mineral so important as iron should be widely distributed, and it appears that, in the United States, every important section is supplied with it. The largest section or formations which are destitute of the ores of iron and of the metals are the Cretaceous and Tertiary, which skirt the Atlantic coast, and which form our great basins and valleys. So, also, the Silurian and

Devonian systems are in a great measure destitute of iron ores, with the exception of the argillaceous and oolitic ores of iron of the Clinton group.

7. I have already spoken of the value of the lead ores of Wisconsin, Missouri, and Iowa. The highest estimate which I have noticed of the probable productive capacities of the lead region is from one hundred to one hundred and fifty millions of pounds annually, having already reached that of fifty millions under unfavorable circumstances.

8. The production of copper is in its infancy. It is too early to attempt to determine the value of its mines, and yet the Lake Superior copper district has already produced two thousand tons in a single year. The value of the copper which has been produced, equals, at twenty-five cents per pound, $2,700,000. The copper region which ranks next in value is in North Carolina. It has been referred to. The ore is the yellow sulphuret; the country is far better adapted to mining than that of Lake Superior. Indeed, it is of all others the best, whether we consider its climate, its means of sustaining a mining population at a cheap rate, or the production of timber for shafting, tunnelling, fuel, etc. We do not yet know the real extent and value of its copper ores, but we have not the least doubt of the ultimate success of its copper mines.

It is not to be expected, however, that one-quarter of the veins which are now being tested will prove to be mines. Even if one in ten turn out well, North Carolina will become one of the richest mining districts in the Union.

The resources in copper in Tennessee are also remarkable, and particularly so, as several mines became productive from their first trials. I allude to those of Ducktown.

9. Although gold has been obtained in considerable quantities for half a century, still the mines and deposits have not been worked in a systematic manner. Gold mining operations have been conducted in the loosest manner. Present and immediate gains have been sought for, and hence no permanent works have been erected, except in a very few instances. Within the last two years, more system and more capital have been employed, and a better and more consistent view is now taken of gold mining, and the prospect is becoming daily more favorable to the enterprise. North Carolina is the centre of the gold region, and will rank in value next to California. There are no accurate returns for the amount of gold North Carolina has furnished. Of the gold of California, the estimated production is less than the actual. The Hon. T. Butler King estimated it for 1848–9 at $40,000,000.

10. Our plaster, salt, marble, granite, and freestone, form other large items of mineral wealth with which the United States abound. In the list of mineral property, mineral springs should not be forgotten. They administer to the health of the people.

11. The only mines of quicksilver which are now known in the United States, are situated in Santa Clara, twelve miles from San Jose, in California. It is found in bunches in ferruginous clay, forming in part a hill 1,360 feet above tide. It is associated with broken-down magnesian rocks. The deposit is large, but no accurate returns of the yield of quicksilver have been published. The mine is being worked in a systematic manner.

We have no mines of tin, properly speaking.

I have said nothing of coal. It is almost impossible to measure or weigh in calculation its amount. But President Hitchcock observes truly, that the whole amount, in solid measure, of the coal in the United States, equals at least 3,500,000 square miles.

When it is considered that our country is destined to support its hundreds of millions of souls; that its fleets, its mines, its manufactures, its locomotives, and the domestic firesides, must depend upon its mineral fuel, and when we also estimate the vastness of our resources in the mineral kingdom, we cannot but see that everything necessary for prosperity has been provided with the most liberal hand, and on the most gigantic scale; and has, more-

over, been so distributed as to accommodate the many and the most distant parts of the Union. There can be no centralization of products and resources, so as to confer a preponderating influence on a few favored sections of the Union, in the south or in the north. But enterprise and industry may create anywhere a prosperous community by availing itself of those natural mineral and manufacturing resources which are provided throughout the land. Where these do not exist, agriculture comes in to supply the necessary elements of prosperity. Nature had no sectional favors to dispense when she grew the coal plant for nine hundred miles from north to south, and more than a thousand miles from east to west, extending over an area of a million of square miles, and at the same time distributing her iron and other metals still more widely; to say nothing of the lands and mineral productions upon the Pacific slope.

Although I have not pretended to present a statistical account of our mineral resources, and what is recorded in the foregoing paragraphs is exceedingly meagre and unsatisfactory, still enough has been said to prove that our mining interests are to become one of the great sources of wealth, and that the real additions to the wealth of the nation is hereafter to be largely derived from its mines and quarries.

Part II. will contain a description of the Taconic and Silurian systems, as they are developed in this country.

JOURNAL OF MINING LAWS AND REGULATIONS.

THE MINING CODE OF VENEZUELA.

The following Mining Code was adopted by the Congress of Venezeula at it session which has just closed:—

OF PROPERTY IN MINES.

Article 1. No mines can be worked except under a concession granted by the Executive. The auriferous tracts in the Province of Guiana are excepted from all concessions; nevertheless, they can be worked with a permit upon such regulations as shall be made, and by paying a tenth of the net product into the treasury.

Article 2. The Executive grants perpetual proprietorship of a mine, which is thereupon transmissible like other property, and the owner cannot be dispossessed except in accordance with forms prescribed by law for any other property. The mine may be sold or ceded by shares without any previous authority from the Executive.

Article 3. Mines are real estate. The same are the buildings, machinery, shafts, and other works undertaken in a permanent manner. The same, according to their purpose, are the horses and utensils for working the mine. Nevertheless, the shares or interest of a company or undertaking for working mines, will be regarded as personal property, so likewise the ores extracted, provisions, and other movables.

Article 4. The tax to be paid for the evidence of title to mines (deeds, &c.) into the treasury is $30 for each claim. Such duties will form a fund to pay the expense of mining and mechanical schools, which will be established in each of the mining provinces. No public officer can dispose of this fund to any other purpose without becoming liable to repay the same amount.

[To be continued.]

COMMERCIAL ASPECT OF THE MINING INTEREST.

NEW YORK, *Sept. 30th*, 1854.

The commercial value of mining stocks continues exceedingly low; and in respect of merely fancy stocks, almost *nil*. Many of these stocks have become for the moment valueless from the extreme want of foresight in omitting to provide a sufficient working capital. In many companies there has been no reserve even of stock for this purpose; in others, the decline in the market value has rendered the reserve inadequate; but in all cases the management is a bad one which does not provide a cash capital for working mines. The money market has long since failed to aid those companies who depended on it for the disposal of reserved shares, from time to time, to raise money for current expenses. Good managers provide for these out of the subscriptions to the stocks, and do not proceed in their enterprise until these are made secure. Too many companies have been got up merely for stock speculation, and these are suffering the most, many of them disappearing altogether.

There is very great difficulty in collecting together a sufficient number of the stockholders of the various mining companies for consultation. This apathy is very injurious, as it hinders the necessary action. The advice, opinion, and countenance of the stockholders is often essential, though no advances may be required from them; and it is highly reprehensible to abstain from attendance merely because parties are resolved to incur no increase of responsibility.

With the exception of coal stocks, the most active one has been the stock of the *Gold Hill Mining Company*. Large sales have been made in it at $2\frac{1}{4}$, seller's option sixty days, and a few at $2\frac{3}{8}$ cash at the close of the month. The now usual bi-monthly dividend of 2 per cent. has been declared, (equal to ten cents per share,) payable on the 2d of October.

The *Ohio Land and Marble Company* is in difficulties, and the property has been, by a resolution of the company, sold to one of its largest stockholders. The party has, however, not complied with the terms, but further time to do so has been granted. The terms, we learn, are the immediate payment of all floating debts of the company, the surrender of his own stock, and the future payment of one dollar per share to the other stockholders, for which the property is to be mortgaged. If carried into effect, the purchaser will send down a colony of Germans on the estate for its proper working.

The stock of the *Berdan Machine Company* has been very active during the month at improved rates. Sales have been reported as high as $12.50 and $12.75, the former being freely offered. The company, it is stated, have disposed of the right of manufacturing and using twenty machines, within the last two months, yielding a profit of $80,000. The English Company of the same name pays a royalty to the New York Company; and many machines have been made in London for Australia and for Germany. The company promise a dividend in October of 7 per cent., which is $1.75 per share.

We learn that the rich *Isabella Mine* of Polk county, Tennessee, is being worked with much success. Mr. Oram, the mining captain, states that the pumps are at work in the engine shaft, which is sunk about 80 feet, of which fifteen feet penetrate a very rich black ore, yielding fifty per cent. of pure metal. The drifting has been carried between 60 and 80 feet at the bottom of the shaft through the rich ore mentioned, and affording a large extent of

(*Continued on Page 405.*

Fluctuations to Sept. 23d, 1854, in the different Mining Stocks sold at the New York Stock Exchange and Mining Boards, showing their Highest and Lowest Points, and the Date, with the Market Value at this date, Gain or Loss for the month, and number of Shares sold.

Name of Stock.	Shares.	Par.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value Sept. 23.	From Aug. 26. Gain.	From Aug. 26. Loss.	Shares Sold.
Aberdeen	—	—	—	—	—	—	—	—	—	—
Algomah Copper	—	—	—	—	—	—	—	—	—	—
Allegheny Coal	—	—	—	—	—	—	—	—	—	—
American White Zinc	—	—	—	—	—	—	—	—	—	—
Brookdale Lead	—	—	—	—	—	—	—	—	—	—
Buckingham Gold	—	—	—	—	—	—	—	—	—	—
Breckenridge Coal	—	—	—	—	—	—	—	—	—	—
Berdan's Crusher	—	—	—	—	—	—	—	—	—	—
Caledonia Coal	—	—	—	—	—	—	—	—	—	—
Calloway	—	—	—	—	—	—	—	—	—	—
Charlotte Copper	—	—	—	—	—	—	—	—	—	—
Chatham Cobalt	—	—	—	—	—	—	—	—	—	—
Conrad Hill Gold	—	—	—	—	—	—	—	—	—	—
Copper Falls Copper	—	—	—	—	—	—	—	—	—	—
Cumberland Coal	50,000	100	33¼	13	27	30	33	3	—	57,597
Dauphin and Susquehanna Coal	—	—	—	—	—	—	—	—	—	—
Dauphin and Susquehanna 7 per cent. Bonds	—	—	—	—	—	—	—	—	—	—
Dolly Hyde Copper	—	—	—	—	—	—	—	—	—	—
Duchess Silver	—	—	—	—	—	—	—	—	—	—
Douglas Houghton Copper	—	—	—	—	—	—	—	—	—	—
Flint Steel Copper	—	—	—	—	—	—	—	—	—	—
Fulton Copper	—	—	—	—	—	—	—	—	—	—
Franklinite Scrip	—	—	—	—	—	—	—	—	—	—
Gardiner Crusher	—	—	—	—	—	—	—	—	—	—
Gardiner Gold	400,000	—	—	—	—	—	—	—	—	—
Georgia Gold	—	—	—	—	—	—	—	—	—	—
Gold Hill	200,000	5	2¾	15	2½	22	2¾	—	¼	11,000
Hiwassee Copper	—	—	—	—	—	—	—	—	—	—
Isabella	—	—	1½	23	—	—	—	—	—	100
Isle Royale Copper	—	—	—	—	—	—	—	—	—	—
Lindsay Gold	—	—	—	—	—	—	—	—	—	—
McCullough Gold & Copper	200,000	5	1½	28	1	12	1½	—	½	850
Manitou Copper	—	—	—	—	—	—	—	—	—	—
Manassas Copper	—	—	—	—	—	—	—	—	—	—
Mineral Mining Co	—	—	—	—	—	—	—	—	—	—
Middletown Silver Lead	—	—	—	—	—	—	—	—	—	—
Montgomery Zinc	—	—	—	—	—	—	—	—	—	—
National Copper	—	—	—	—	—	—	—	—	—	—
Neuvitas Copper	—	—	—	—	—	—	—	—	—	—
New Creek Coal	—	—	—	—	—	—	—	—	—	—
New Jersey Zinc	96,000	12½	6	11	5½	25	5½	—	—	3,400
North American Copper	—	—	—	—	—	—	—	—	—	—
North Carolina Copper	—	—	—	—	—	—	—	—	—	—
Ohio Land & Marble	—	—	—	—	—	—	—	—	—	—
Passaic Mining & Manuf. Co.	—	—	—	—	—	—	—	—	—	—
Pennsylvania Coal	50,000	50	102½	23	96½	11	102½	2	—	1,300
Pennsylvania & Lehigh Zinc	—	—	—	—	—	—	—	—	—	—
Phœnix Mining and Manufacturing Co	—	—	—	—	—	—	—	—	—	—
Phœnix Gold	—	—	—	—	—	—	—	—	—	—
Potomac Copper	—	—	—	—	—	—	—	—	—	—
Potosi Lead	—	—	—	—	—	—	—	—	—	—
Randolph	—	—	—	—	—	—	—	—	—	—
Ripley Copper	—	—	—	—	—	—	—	—	—	—
Rockland	—	—	—	—	—	—	—	—	—	—
Rocky Bar Gold	—	—	—	—	—	—	—	—	—	—
Rutherford Gold	—	—	—	—	—	—	—	—	—	—
Toltec Copper	—	—	—	—	—	—	—	—	—	—
Ulster Lead	—	—	¾	—	—	—	—	—	—	—
Vandenberg Gold & Copper	—	—	—	—	—	—	—	—	—	—
Vermont Copper	—	—	—	—	—	—	—	—	—	—
Winthrop Copper	—	—	—	—	—	—	—	—	—	—

Note.—There has been no sale of the stocks of those Companies opposite to which the above table is blank. Our reports in a former Number furnish the amount of the last sales.

* Ex dividend.

stoping ground, besides the stoping grounds furnished by the other levels previously opened.

The stock, we observe, is in demand at $1¼ per share, but very little is to be obtained at that price.

With respect to the negotiation with the English Company for the purchase of a number of the Tennessee mines, to which we alluded in our last number, we learn that Mr. Brain had arrived in London, whence he writes that his report was favorably received, and that Mr. Brain, one of his principals, would arrive here in October to complete the arrangements.

The *Lake Superior* mines are the most productive of any, though a few of the newly-organized companies have been obliged to suspend work for want of means. It was found that the old *Manitou Mining Company* was not legally organized, and in fact had no title to property; consequently they could not enforce the collection of an assessment which had been made of 25 cents per share. Some of the original proprietors, finding that they had a remarkable property, on which a very promising vein had been discovered, organized a new company under the general mining law of Michigan; and as the holders of scrip in the old association were entitled in equity to the stock in the new company, it was resolved to issue new stock to them pro rata on the surrender of the old certificates, and the payment of 50 cents per share assessment, in addition to 25 cents made by the old association for carrying on the mining operations. The above includes all the payments on the stock, except the $5,000 paid for the location by the original holders. Mr. A. H. Stevens writes from the mine that it is equal to the "Star Mine." There is, however, no market for the stock of this or any other mines.

Vermont State we observe has given birth to a little nest of copper mining companies, namely, the Vermont Mining Company, the Corinth, the Belmont, and the Barnard.

The *Vermont Copper Company* commenced operations last November under a charter from the Vermont Legislature, and its mines are situated in Vershire, Orange county, Vermont. The property consists of 375 acres, within less than seven miles from the line of the Connecticut Railroad, and is therefore favorably situated for cheap transport, estimated at six dollars per ton to this city, and at five to Boston. The vein which is at present being worked ranges from 8 to 16 feet in thickness, the ore being the yellow sulphuret of copper, mixed with the various oxides, green carbonate, and native copper. Its course is nearly due north and south, with a dip or underlay to the east of about 3 feet to the fathom when near the surface; but on descending, it rapidly becomes more vertical, and the probability is that it will eventually be found to run at right angles to the base of the mountain in which the mine is situated.

The working of the vein was first commenced at the foot of the mountain, but since that time other openings at different points have been made, with good results; for the ore, at the height of 600 feet, is found to be of quite as rich a quality as that mined at the base. Owing to the situation of the mine, the expenses of working will be much below the average, as there can be no interruption from an influx of water, &c., the mine by its position draining

itself. The buildings and machinery, capable of crushing and dressing upwards of 150 tons per week, are now nearly completed, and will be in working order in the course of the next two months, we are informed by Mr. Henry Barnard, who has devoted several years to the development of the mineral resources of the country, more especially to those of Vermont. Mr. Barnard was the first to direct attention to the vast mineral wealth of Vermont. The Company's land is well timbered, sufficient for many years to supply all the fuel wanted, hence the cost of raising and dressing the ore will only be about five dollars per ton, making its cost in this market less than $12 per ton. The Company says it has given no mortgage on its property, and is not in debt, while it has several hundred tons of ore ready for dressing on the surface, and expect to send weekly to market one to two hundred tons of ore.

The coal mining companies are the only ones whose stock sells readily. Among these *Reading* takes the lead. The stock has recovered from the depression incident on its passing the dividend. The road is doing a full business at very profitable rates, and the demand for coal will keep it active.

The coal companies depending on canal transport have been hampered by the drought, which has deprived the canals of water. The difficulty is now removed, but the result is unfavorable to a full supply of coal by the *Delaware and Hudson Canal Company* and the *Pennsylvania Coal Company*. The high price of coal, however, has been felt by these two companies, whose stocks are at a premium, and strongly held from a wide distribution. When a large mass of the stock of the Delaware and Hudson Canal Company was held by one individual, it was occasionally heavy in price, but since the distribution of that mass, little stock is to be bought, and only at an advancing price. The *Cumberland Coal Company* is doing a profitable business. Its weekly receipts are a little reduced by the Canal difficulty, but its finances are in good order. Its stock has assumed a steady character in the market.

The *Phœnix Coal Company* has ceased to send coal to market, as the mines have been leased to J. C. Manning of Baltimore. The Company is winding up its affairs. The present President is David D. Voorhies. The stock has been sold this month at $2 per share.

The *Parker Vein Coal Company* is at a stand. The Directors are authorized to take measures to withdraw the over-issues of stock, which done, the transfer books will be opened. An active party who has sold stock on contract wanted the books opened at once, but the Directors justly felt that they can only deal with that number of shares allowed by law, and that the excess must first be withdrawn. This they are taking measures to do.

BOSTON MINING SHARE MARKET.

BOSTON, *Sept.* 20, 1854.

We had confidently hoped that ere this a decidedly improved tone would pervade the market for mining shares, but our hopes have not been realized, and the same dull, stupid inactivity continues, that has completely paralyzed the market for many months. All this is in the face of excellent news from the mining region, and the strongest indications that mining property is becoming permanently more valuable every day.

A serious difficulty in the success of mining enterprises is the fact that a large portion of the present stockholders became such with a speculative object in view, presuming that in a few months they should be enabled to sell out at a large profit. Various circumstances have operated adversely for such results, notwithstanding that the mines are making a better show than ever, and holders now find themselves loaded up with stock at high rates, which cannot be realized upon without immense sacrifices. In some instances the shares will not bring more than the amount which has been assessed within six months or a year for the successful prosecution of the mining operations, and under these circumstances many holders have become wearied with "hope deferred," and others, less fortunate, have been compelled to sell a portion of their stock to effect the payment of assessments on the balance. This state of things has become so general as to cause a feeling of distrust to prevail in regard to all mining stocks, good or bad, and very many are led to think that they never will be valuable again. We do not apprehend any thing of that kind, however, although the non-payment of assessments due is a serious stumbling-block in the way of success, for many of the new mines are thus cramped in their operations, and in some cases even obliged to suspend work from want of funds.

We notice that new mines of copper, gold, and silver, are continually being discovered in various parts of the country, and some of them give promise of great richness. In Dahlonega (Georgia) a rich vein of ore has been discovered, which yields upwards of 30 per cent. of copper. The vein also contains a rich deposit of malachite or carbonate of copper, which is of a beautiful green, and highly valuable for decorative purposes in building and for other ornamental purposes, being more valuable than copper. Gold has been discovered in Alabama, New Hampshire, Vermont, and other sections of the country, in moderate quantities, but not perhaps in sufficient abundance to pay well for permanent working, though parties have already commenced operations with a view to test its real value.

The *North American* Mining Company have postponed the time of their annual meeting from August to November, or until after the close of navigation, and consequently the business season. This change is an excellent one, and will enable the Directors, in their annual report, to furnish a much more complete and satisfactory statement of the company's affairs than could be done in August. Owing to the peculiar nature of mining business at the Lake, the close of the season would seem the most appropriate period for presenting a report of the past year, and other companies may do well to follow the example of the North American. The mine is opening well, and proves exceedingly rich as the work progresses south on the vein, and also in sinking on the lower levels. The new stamping and washing machinery will not be in operation for a month or more to come, in consequence of delay in forwarding the boiler of the engine, and therefore the amount of copper shipped the present season will be less than had been anticipated. The success of the company is sufficient, however, to warrant a handsome dividend within the year 1855, which will doubtless be regularly continued thereafter.

The *Pittsbury*, which is the most familiar name for it here, though sometimes called the "Cliff Mine," is raising an average of more than 100 tons of copper per month, and employs over sixty men in cutting copper, with sufficient blasted down to employ them for several months. A new discovery has lately been made in level No. 7, north, of a "mass" which has been opened 80 feet in length, and 20 feet high, and cannot be moved with several kegs of powder. It is supposed that this will prove the largest mass ever found in any of the mines at the Lake, and will add greatly to the worth and popularity of the Pittsburg, besides having a very good effect on the prospects for success of other mines, yet in their infancy of development. The Pittsburg stock has advanced from 137 to 140, ex dividend, and the shares are scarce in the market.

The *Copper Falls* mines are improving, and now turn out stamp and barrel work in immense quantities. The present number of stamps in operation (24 heads) is entirely inadequate for the product of the mines, and 24 more are now being put up, which, together with the new patent machinery for stamping and washing mentioned last month, will make a force fully equal to one hundred heads of stamps. The mines are fully capable to supply this large number with stamp work, and when they are in full operation we may confidently look for a very much increased product of copper. We have recently seen some specimens from these mines, which are very rich and beautiful. Notwithstanding the greatly increased value of the mine, and its unmistaken evidence of being a sure thing, the price of the stock continues to droop, with very few buyers in the market at present. The stringent state of money matters is undoubtedly the prime cause of the decline, and is stronger in its influence than the most favorable advices of success are for the opposite effect.

Isle Royale continues firm at 15, and the latest news from the mine is excellent. Several small masses have been met with, the parts of which that are already exposed being estimated as high as 1000 lbs. for some of them, which would give quite respectable "masses" when taken out. The mine improves in richness the lower it has been worked thus far, which is important and highly encouraging. The following extract of a letter, dated September 3d, from the agent, Mr. Douglas, tells well for the prospects of the mine:—

"The Isle Royale mine has never looked more encouraging than at the present time. Lumps and small masses of copper are studding the sides, bottoms, and tops of some of our drifts and shafts, and every day's work in dressing down the vein along the drifts, or in the shafts, adds to the number. We are raising a large amount of stamp and barrel work, and are now in a condition to largely increase the amount as soon as it may be required for stamping. We shall make a shipment of copper about the first of October. The boiler and part of the engine are in place, with the other parts of the machinery under way, and the whole will be put in working order with all possible dispatch."

The work at the mine is being prosecuted with the greatest vigor, at an expense of about $6000 per month, and the managers are determined to develope the mine without delay, so that the least possible time may elapse before

the enterprise reaches a dividend-paying point. Another year will advance the prospects of Isle Royale very much, and place it in a prominent position before the public.

National is heavy at 20, and at present there is little disposition to purchase the stock, although the mine is showing well, and gives the best evidence of ultimate success. The lawsuit in which the company is now engaged probably has an effect on the stock, together with the present state of the market for every kind of a mining stock. *Minnesota* is offered at lower figures, but not from any want of success at the mine, for there every thing looks bright and prosperous. The large amount of money necessary to purchase the shares renders it very difficult to dispose of them at fair rates in these times. *North Western* is dull of sale, but it is said the company will ship 150 tons of copper this season, which is the very best commentary on the successful operation of the mine.

The following assessments have been laid since our last:—

COMPANIES.	AM'T PER SHARE.	WHEN PAYABLE.	WHERE PAYABLE.
Manitou,	50 cts.,	September 25,	New York.
Algomah,	$1,	October 16,	Boston.
Forest,	$3,	October 13,	Boston.
Forest,	$2,	January 2, (1855,)	Boston.

The *Manitou* was formerly an association, but has now been organized, under the general mining law of Michigan, with 20,000 shares, and holders of scrip in the old company will be entitled to shares in the new, *pro rata*, on surrender of the old certificates, and payment of all assessments due; 25 cents per share, only, has been called in previous to the present assessment of 50 cents. The assessment on *Algomah* has had the natural effect to depreciate the market value of the stock, and 1¼ is now the asking price. The company have an excellent vein, that of the Toltec, and the prospects of success are good, which of course renders the raising of funds necessary. Previous to the present call of $1, only 37½ cents has been paid in.

The Directors of the *Forest* announce that the above assessment of $5 per share is the final one required for bringing the mine to a dividend-paying point. The mine has improved materially the present season, and bids fair to do a fine business the coming winter, its facilities for working being as good as the best. The new stamp works will be in operation by October 1st or sooner, and are a great improvement on the old ones destroyed by fire early in the season. The expenses for the new works and other improvements, have been very heavy this summer, but the company will ship about 100 tons of copper before the close of the season, which speaks well for it under the circumstances.

Toltec has declined to 6¼ under the general pressure, and this low price includes the September assessment of $2, making in all $8 paid in. No further assessments will be called until the spring of 1855, when a final one will be laid, of not less than $2 per share. The mine is looking remarkably well, from last accounts, and there is not the slightest doubt of its complete success in due time, although efforts have been made to impress the idea upon the public that the veins were giving out—a report the most ridiculous that

could be circulated, and not deserving of the slightest credit among those who know best of its true value.

Ripley has declined to $1, with very few purchasers; an assessment of 25 cents per share, previously announced, will be due September 25th. The friends of this concern still hold out that they shall produce a good mine from the property, but thus far all have been sorely disappointed in their expectations. It was presumed, when the company was started with 40,000 shares, at $2 paid in, that the proceeds would be amply sufficient to carry out the work of bringing the mine to a practical point, when dividends would be forthcoming; instead of this, however, an assessment of $1 per share was levied last summer, for the further development of the mine.

Bohemian makes but little show, and although the company is supposed to have a fair property, it was "gassed up" altogether too high at the first go off. It is hard to sell the stock at any price, but still there is some prospect that the mine will yet come out right.

Dana is showing very fair, with some prospect of ultimate success. We much doubt, however, if it ever proves a great mine, though the Copper Falls made equally as poor a show some years since, and much of the stock was then forfeited for non-payment of assessments.

Fulton is flat at 50 cents per share, and few here are disposed to buy the stock at any price. The past management of the concern is looked upon unfavorably by parties in this vicinity. We hear a proposition spoken of to reduce the number of shares to 20,000. This would doubtless be good policy, as 100,000 shares is enough to swamp any concern, especially if got up for speculative purposes.

Norwich is very dull and heavy at $4 asked. This mine is said to be doing very well, but the financial embarrassments of the company have operated to materially reduce the market value of the stock.

Phœnix is looking much better than some months since, and there is every indication that it will make a paying property. The managers are the right sort of men, and will bring it out right if such a thing can be done, of which we have but little doubt. Money will of course be needed for this purpose, and probably an assessment of $1 per share will be called for some time in November.

Winthrop is turning out small pieces of copper with an excellent show, so far as the mine has been opened. We have little doubt that the Winthrop will make a good, paying mine, but as yet the amount of work done on it is comparatively small, and it will take time and money to bring it out.

Star improves steadily, but the heavy calls for money lately, together with the very bad state of the market, has reduced the price of the stock, so that not more than $6 per share could be obtained with the $2 assessment included. The work of opening the mine is progressing finely, however, and the Star will give a good account of itself another season.

Webster has declined to 75 cents asked, and no bid. Thus far but little success has been found, and the rank of the mine will depend altogether upon future discoveries.

Shawmut makes a tolerable fair show, and would do better but for the cramped condition of the finances, in consequence of the non-payment of assessments. The delinquent stock will probably be sold to the highest bidder soon, and by that means sufficient funds will be raised for the successful prosecution of the work.

Native is very dull, and $1¼ is asked for $4.75 paid in. The mine gives very fair indications of success, but in consequence of the high price of mining labor and supplies, little if any progress is now being made with the work.

The following table of the transactions for August presents an unusually limited amount of business, and a marked depreciation in the value of many of the stocks:—

BOSTON MINING SHARE LIST.

Fluctuations for August, 1854, in thirty-one different Mining Stocks, sold at the Boston Stock and Exchange Board, showing their Highest and Lowest Points, and the Date, with the Market Value at the close of the Month, Gain or Loss for the Month, and number of Shares sold in each.

Mining Stocks, Boston.	Nominal Capital.	Shares.	Par.	Paid in Sept. '50.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value Aug. 31.	From July 31, Gain	From July 31, Loss.	Shares sold in August.	Value Sept. 20
Adventure, *Copper.*	$250,000	10,000	25	$11.00	—	—	—	—	1½	—	¼	No sale.	1½
Algomah	500,000	20,000	25	1.87½	1½	22	1½	1	1½	½	—	900	1½
Bay State	500,000	20,000	25	‡2.00	—	—	—	—	½	—	¼	No sale.	½
Bohemian	250,000	16,666	15	4.94	—	—	—	—	1½	—	½	No sale.	1
Boston	500,000	20,000	25	‡2.00	—	—	—	—	¼	0	0	No sale.	¼
Copper Falls	300,000	10,000	30	18.00	53	21	44	11	54	9	—	86	48
Dana	500,000	20,000	25	1.62½	1	1	1	—	⅜	—	⅛	20	⅜
Forest	200,000	10,000	20	15.00	—	—	—	—	10	0	½	No sale.	6
Fulton	500,000	100,000	5	‡2.00	70	16	62½	5	62½	—	½	650	¾
Glen	500,000	20,000	25	‡2.00	—	—	—	—	¼	—	¼	No sale.	¼
Isle Royale	120,000	12,000	10	10.00	55	28	40	15	14½	7	—	No sale.	15½
Malone, *Sandstone.*	440,000	40,000	10	8.12½	—	—	—	—	47	2	—	445	45
Manassas, *Mining*	1,000,000	100,000	10	‡2.00	—	—	—	—	¼	0	0	No sale.	¼
Manitou, *Copper*	500,000	20,000	25	0.25	—	—	—	—	⅛	0	0	No sale.	⅛
Minnesota	300,000	8,000	100	22.00	174	13	174	18	176	6	5	7	172
National	250,000	10,000	25	8.00	—	—	—	—	20	—	—	No sale.	20
Native	250,000	10,000	25	4.75	—	—	—	—	1¼	—	—	No sale.	1
North American	300,000	10,000	30	21.50	6	30	5	30	6¾	—	⅜	No sale.	60
Norwich	100,000	20,000	5	‡5.00	5	30	5	30	5	0	0	20	4½
North Western	300,000	9,000	33⅓	14.67	22	19	22	8	23	0	0	93	22
Phœnix	300,000	10,000	30	7.00	7½	12	7½	12	7½	0	0	10	6
Pittsburg, (*Cliff*)	.....	6,000	—	18.50	147	26	140	8	147	7	—	24	*140
Ridge	.....	10,000	—	0.50	—	—	—	—	5½	—	—	No sale.	6
Ripley	.....	40,000	12½	2.50	—	—	—	—	2	0	0	No sale.	1
Shawmut	500,000	20,000	25	8.00	—	—	—	—	¼	—	⅛	No sale.	¼
Star	500,000	20,000	25	5.50	—	—	—	—	‡6	0	0	No sale.	‡6
Summit	500,000	40,000	12½	‡5.00	—	—	—	—	5	0	0	No sale.	5
Totoe	500,000	20,000	25	8.00	6	18	5	1	5½	0	0	1,116	6½
Winthrop	500,000	20,000	25	1.25	1½	25	1½	9	1½	¼	—	220	1½
Webster	200,000	40,000	5	‡2.00	—	—	—	—	⅛	0	⅛	No sale.	⅛
W. Castleton, *Slate*	1,000,000	50,000	20	‡6.00	—	—	—	—	2	0	0	No sale.	2

† Assessment paid.

‡ These are fully paid stock, not assessable.

* The dividend of the *Pittsburg* (Cliff) Copper Co. of $3 per share, announced in our last, was paid Sept. 11 to holders of stock, Sept. 1.

We have changed the amount paid in on the *Manitou* from $1.25 to 25 cents, which is the true amount, thus far, (Sept. 20th,) and 50 cents will be due September 25th.

NEW YORK METAL MARKET.

September 26th, 1854.

COPPER, INGOT.

South America	per lb.	29c
United States	"	31c
Sheathing, 16 oz. and upwards	"	29½c
Bronzers'	"	35c
Old Sheathing	"	26c
New Bolts	"	35c
Wire, 10c per lb. additional to card prices brass wire per No. Tubing	"	45c
Copper ore 30 per cent. per ton		$120 to 150

Copper ores are sold per rate of yield, 30 per cent. ore is worth four to five dollars per one per cent. of yield.

Composition Sheathing.....per lb. 26c

IRON.

Duty 30 per cent. ad val.

American Hammered Bars	per ton	$85a90
" Refined iron	"	85a90
English common iron	"	60a70
" Refined iron	"	80
Swedish Bars	"	90a92.50
Railroad Bars	"	77.50a80
American Sheet	per lb.	5½c
English " No 1 to 20	"	4½c
" " 21 to 24, incl.	"	5½c
" " 25 to 28	"	6½c
Russian "	"	14½a15c
English Hoop	per cwt.	$5
Amer. "	"	5
Common Bloom	per ton	45a50
Good "	"	50a55
First q'lty "	"	55a58
Refined "	"	70a74

Galvanized, card price as follows:

No. 14	per lb.	10c
16 and 17	"	10½c
18 and 19	"	10⅝c
20	"	10⅞c
21, 22, 23, and 24	"	11½c
25	"	12½c
26	"	12½c
27 and 28	"	13½c
29	"	14½c

Net, 6 months' prices.

Scotch Pig. No. 1	per ton	$36a39
No. 1 American, No. 1 Brands	"	32a34
" 1 " No. 2 "	"	22a25

LEAD.

Spanish	per 100 lbs.	$6.81½a6.44
American	"	6.62a6.75
English	"	6.81a6.90
Bar	"	7a7.25
Sheet	"	7.25a7.50
Pipe	"	7.25a7.50

NAILS.

Cut 4da60d	per 100 lbs.	4¼a4¼
Wrought 6da20d	"	8 a10

SPELTER.

Duty:—In Pigs, Bars, and Plates, 5; Sheets, 15 per cent. ad val.

Plates..... $8½

STEEL.

Duty:—Cast, Shear, and German, in bars, 15; all others, 30 per cent. ad val.

English	per lb.	$16 a16
German Cast	"	13 a14
English Spring	"	6½a 7½
American Spring	"	5 a 5½
English Blister	"	9 a14
Common American Blister	"	4½a 5
Milan, (in bond)	"	5½a 5½
Steel Cast—American	"	9 a16
Steel Cast—Sheffield	"	16 a18
Hoop M N L	"	9 a14
Common English Blister.	"	4 a 5

Terne Plates—Coke .....14x20 at $9.25 cash.

TIN.

Banca	$28a29
Straits	27½a28
English	—
Bar	—
Plates—IC Coke, cash	8a8½
" ½ X Charcoal	10a10.25

ZINC.

Duty:—In Pigs, 5; in Sheets, 15 per cent. ad val.

In Sheets.....per lb. $8½a 8½

LONDON METAL MARKET.

September 8th, 1854.

COPPER.

	£	s.	d.
South American	124	0	0–126

IRON.

Pig, No. 1, in Wales	4	15	0– 5	5	0
Bars, common, ditto	8	15	0– 9	0	0
Ditto, Swedish, in London	13	0	0–14	10	0
Pig, No. 1, in Clyde	4	3	0– 4	3	6

LEAD.

English pig	22	10	0–23	0	0
Ditto sheet	23	10	0–24	0	0
Ditto white	28	10	0–29	0	0
Ditto patent shot	26	0	0–26	10	0
Spanish, in bond	22	0	0–23	0	0
American	none.				

FOREIGN STEEL.

Swedish, in kegs	per ton	21	0 0–	—
Quicksilver	per lb.	0	2 1–	

SPELTER.

Foreign	per ton	21	15 0	—

TIN.

English, blocks	114	0	0–	—	
Ditto, bars (in barrels)	115	0	0–	—	
Ditto, refined	118	0	0–	—	
Banca	114	0	0–115	0	0
Straits	110	0	0–111	0	0

TIN PLATES.*

IC Charcoal	per box.	1	14 0–1	15	0
1X Ditto	"	2	0 0–2	1	0
Canada plates	per ton.	16	0 0		

In London, 20s. less at the works.

* At the works, 1s. to 1s. 6d. per box less. In Liverpool, 6d. per box less.

JOURNAL OF GOLD MINING OPERATIONS.

CALIFORNIA MINT.

The following statement will show the operations of the San Francisco Mint for the quarter ending June 30:—

UNPARTED BARS.	
Before melting,	118,465,60 ounces.
After melting,	114,122,88 "
Value,	$2,125,717.57
PARTED BARS.	
Before melting,	286,12 ounces.
After melting,	275,75 "
Value,	$5,166.68
COIN.	
Before melting,	106,141.11 ounces.
After melting,	103,685.07 "
Value,	$1,801,942.85
Total value,	$4,032,827.10

"Unparted bars" are those from which the silver has not been extracted. The "parted bars" contain only the gold, and the reason of the small demand for them is, that parties who desire the silver extracted, prefer coin, as being more merchantable.

CALIFORNIA GOLD FIELDS.

A very definite view of mining operations in various districts of California, at the present time, is presented in the following summary of the latest reports:—

Grass Valley.—We have visited, personally, many of the claims in and about Grass Valley during the past week, and feel more than ever convinced not only of the richness, but of the extent and permanency of the mining interest in this vicinity. It is not necessary for our citizens to strike off for other localities, for there is here, in our very midst, an abundance of work, with sufficient remuneration. Since our last issue, diggings have been struck, large in extent and rich in material.

Foust and Company, at Woodpecker ravine, have got into an extensive lead, where they have rich dirt and plenty of it, and three or four men are now taking out the ore at the rate of two pounds per day.

At Pike Flat, and so up the above mentioned ravine, we found crowds of men at work, all doing well, and singing and laughing amidst the sound of the windlass and shovel, as if they felt sure in their contentment that their piles lay in the dull, heavy earth under their feet.

At Pike Flat, Mr. G. Morehouse found a specimen weighing ten and a quarter ounces, and supposed to contain $75; also took out one pan of dirt that contained $50.12½ on Saturday evening last.

On last week, some of our citizens prospecting in the flat, back from Main street, struck an old lead which was lost in 1851, which paid then, and does now, four bits to the pan. In this lead there is work enough for a large company for two or three years.

The work on the slide is progressing, and we shall soon, no doubt, have astonishing news from that quarter. The Eureka tunnel, and other claims in that vicinity, are still paying well.

Several of the quartz leads are prospering to a degree, and, to our certain knowledge, the Empire Company is receiving large pay, and is working with large prospects.

Iowa Hill.—It is said, that on account of the scarcity of water, mining operations at this point are at present somewhat dull. As a matter of course, this causes a dearth of business in other matters, and as a consequence to this, people are leaving, to be absent awhile attending to other and outside business. By all acquainted with this locality, it is, however, conceded that the place will become more lively than ever so soon as the return of the water shall again offer its requisite inducement. It is, however, a matter worth noting, that the Wisconsin Company took last week, from a single pan of dirt, the sum of $522. This is, indeed, immense, but not astonishing to any who have heretofore learned the peculiar streaky character of the Iowa Hill leads.

Forest City.—A friend of ours, lately returned from this famous mining point, informs us that a scarcity of water is also rendering the town less lively than has heretofore been represented. Many companies are, nevertheless, still doing well, and a fair remuneration for labor is received. This village, in its general appearance, most strongly resembles a town in '49. The air of ease and independence which characterizes the people—the freedom with which money is expended—the newness of the buildings, etc.—all remind one of the good times gone.

Wisconsin Hill.—This hill is, we understand, in the neighborhood of Iowa Hill, in Placer county. Within the past few days, several very rich claims have been opened upon it, and are being worked by hydraulic power. The richest of the gold deposits are found in a thin strata of sand and gravel, which appears to be cemented together, but which water dissolves very rapidly when thrown upon it from a hose and pipe. The gold, in thin scales, is so thickly deposited in this cement as to be seen very distinctly by the naked eye. Scofield's claim, which is worked by six men, was opened the 13th instant, and sixty-four ounces taken out on the first day. On the second day the Company took out one hundred and twenty-one and a quarter ounces, as we are told by a friend who was present and saw the gold. The members had been six weeks opening the claim. Before reaching the pay dirt, they have to wash down dirt about 100 feet in depth before they come to the paying strata. We have seen specimens of this, and one other claim, which seem to have been taken from the same strata of cement. The dirt which does not pay is washed down and run through a sluice by the use of the hose pipe and a bountiful supply of water. We, however, caution our readers against jumping to the conclusion, that every one who may chance to go there will be sure to strike a claim as rich as Scofield's; because, if they do, more than likely they will find themselves disappointed.

Calaveras County.—R. J. Steele & Co. one week took out sixty-five ounces, making a clear dividend of $265 to the share. The next week they took out ninety-five ounces, and last week eighty ounces; and from present appearances they will make equally as much this week. One share, a few days since, sold for two thousand dollars. Roberts & Co. have struck a vein of blue and yellow clay, into which they have washed eight feet, and it pays them from fifteen to twenty dollars per day to the hand. The New England claim at Saw Flat took out, on the 26th, one piece of pure gold weighing twenty-six ounces. The Deacon claim, adjoining, yielded over a pound of fine gold the same day. Gahegan & Co., on Red Gulch, have taken out several good-sized *chispas* this week, among which was a piece weighing eight ounces. Gold Hill still yields well, and the supply of water is abundant. The reports from Springfield are highly encouraging. A company of five men have struck a new lead at Saw Mill Flat, which promises to pay well. Four companies on Humbug Gulch are extracting at the rate of a pound per day. At Knickerbocker, Shurr & Co. washed out this week twenty ounces in one day and a half. Mr. McLean, while prospecting, found a three-ounce lump, besides getting an average prospect of seventy-five cents to the pan in fine gold. The Coyote Company, at Yankee Hill, took out thirty ounces of coarse

gold on the 25th. The miners on the south fork of the Stanislaus have commenced work in right good earnest.

Mining in the North.—On Smith River and Myrtle Creek the miners are making from ten dollars to twenty-five dollars per day. Laborers are receiving from $100 to $150 per month.

At Sailor Diggings and Althouse Creek the miners were never doing better. These mines vie in richness with any in the State. Labor is scarce and high. New discoveries on Indian Creek are proving rich. The prospect is from one dollar to three dollars per pan. Some of the companies are making from fifty to one hundred dollars per day.

The Jacksonville diggings are exceedingly rich. Some of the miners are making as high as $300 per day. Labor cannot be obtained at any price.

On the Salmon and Klamath the reports are equally favorable with the above.

River Mining.—All accounts of mining operations on the tributaries of the Sacramento are of the most cheering and auspicious character. The streams are unprecedently low for this season of the year, thus enabling miners to prosecute uninterruptedly their enterprises in the channel. The rivers are still falling, and it is believed that by September, the month when the water reaches its lowest point, they will be even lower than at any previous time since the discovery of gold.

One Company, whose operations are on the Yuba River, in the vicinity of Downieville, have already diverted the water through their flume, and are now busily engaged in delving for the shining scales in the bed earth. This association, so far as we have learned, were the first to get to work in the drained stream bottom.

In this vicinity river mining operations are in an advanced state of progress, and, in the course of a fortnight, the north, middle, and south forks of the American will course through channels of plank. There is scarcely a foot of earth, from the source to the disemboguement of these streams, which is not to be effectually drained by means of flumes. The old-fashioned canals, cut through earth, and oft times solid rock, which involved so great labor and expense, are now never undertaken. The idea is exploded.

GOLD IN THE COAST MOUNTAINS.

Gold.—This metal has been found in the Coast Mountains, from the county San Francisco on the north to Lois Obispo on the south. The slates and serpentine formations which have been noticed in the preceding pages of this report, are found to be receptacles of gold here as in the Sierra Nevada; these rocks are extensive in the Coast Mountains, often comprising an entire ridge for miles; they are usually flanked by the granite. During the past summer, the placers in the County Santa Cruz were much worked; the gold found here was principally on the San Lorenzo and its tributaries; it was fine, and much resembled that found in the Caoti Hill, near Nevada; under the glass it had all the appearance of having suffered but little from attrition by water, the surface of the grains being rough, as though just detached from their original matrix. The slates and serpentine rocks occur on both sides of this creek, with small veins of quartz running through them, and from what we know of auriferous districts of this and other countries, the presumption that gold in *situ* exists here, amounts nearly to a certainty.

On the upper portions of the Carmello, in the county Monterey, gold is also found, in the immediate vicinity of the Rancho Tulecita. Farther to the southeast, near the head waters of the creek, it is also found on the tributaries of the main stream that flow from the western ridge of these mountains. On the Francisquito, a tributary of the Carmello, coming from the southwest, and twelve miles from the coast, it is also found near the house of Barondo. Three or four Mexicans were working with the battaya at the time I passed that ranche. The serpentine rocks are largely devel-

oped on the east flanks of the granite ridges, and from their course they may be considered as forming the northern part of a series which occurs at the Mission San Antonio fifty miles south.

I was informed by Mr. Meadows, who has traversed the interior of these mountains probably more than any other man in this part of the country, that the same class of rocks are found throughout the distance inclusive between the Carmello and the above Mission. Near San Antonio there were several persons at work during the past summer, in the placers in this vicinity. This was no new discovery, for the existence of gold at this locality has been known since 1850. Those at work at this place were mostly Mexicans, and while travelling on the Salinas, I frequently met companies of five or six, with their camp material and tools, wending their way to this section.

On the Pescadero Creek, a tributary of the Pajaro River, gold was found during the past summer; it was first observed a short distance above the bituminous springs lying on the north bank of this stream; the serpentine rocks abound in this vicinity, and also some of its subordinate members; at this place the Magnesian Group of the Santa Cruz Mountains, which run north into San Francisco, have their southern terminus. On the Rancho La Brue, near the Pescadero, and into the very edge of the Valley Santa Clara, the talcose series and gold is found; on crossing the Pajaro, these rocks and with them the gold closes; not a trace of this metal, or rock that would indicate its existence, was to be found in any of the hills east of the Gabilan.

The district of country in the Coast Mountains in which the auriferous deposits are now known to occur is about eighty miles in length, and thus far is confined to the counties of Santa Clara, Monterey, and the north part of Luis Obispo. This is a material addition to the already known area in which this metal is found, and its location in what has heretofore been considered the agricultural districts of the State, will in time exert a beneficial influence in the permanent settlement of those sections.—*Professor Trask's Report.*

THE VARIOUS DISCOVERIES OF GOLD IN CALIFORNIA.

The interest naturally attached to so important a discovery as that of gold in California, has hitherto been overlooked in the important results of the discovery itself. At intervals the subject is brought before the public, and often many valuable facts are stated. As an instance of this kind is the following communication, which has been received with considerable interest on the shores of the Pacific, and for the prominent points which it advances, appears entitled to a place in these pages:—

Although the publicity given the supposed discovery of gold at Sutter's Mill, now called Colloma, in California, in 1848—and for some length of time was supposed to be an original discovery—not, as it *was*, a *re-discovery*—has given rise to false opinion in the case in the minds of the public. I, therefore, believing that honor should be rendered to whom honor is due, proceed to give a short sketch of the various discoveries and re-discoveries of gold in Upper and Lower California, as that country was formerly called.

1st. In a volume of a work published in Spain in 1690 by one Lyola Cavello or Cabello, (a padre of the Church of Rome, officiating at the time at the Mission of San Jose, Bay of Francisco, which was built in 1672,) and called "Recordado en Historia el California Alta," he states that on some streams to the north gold was seen, but it was only in small quantities on the "Placeros."

2d. In the year 1842, James D. Dana, A. M., in his System of Mineralogy, page 552 (first edition), says:—"The gold rocks and veins of quartz were observed by the author in 1842, near the Umpqua River, in Southern Oregon, and pebbles from similar rocks were met with along the shores of the Sacra-

mento, in California, and the resemblance to other gold districts was remarked, but there was no opportunity of exploring the country at the time." Again, on pages 251–2, describing the localities in which gold has been found, he says:—"In the Rocky Mountains, near Salt Lake, in California, between the Sierra Nevada and Sacramento and San Joaquin rivers." He also says:—"The California mines are mostly alluvial; the gold is found in the gravel and sands of the valleys and beds of streams leading from the Sierra Nevada into the adjoining valley of the Sacramento and San Joaquin."

3d. During the month of October or November, 1845, in a house or groggery on Pacific street, San Francisco (as it is now called), a Mexican, who was called "Salvador," was shot, because he had a bag of gold dust, described as about 1,000 to 1,200 dollars, and would not tell where he got it. At last, when dying, he pointed in the direction of the San Jose Mountains, and said, "lejos, lejos" (beyond, beyond).

4th. On the 16th of September, 1846, a party, mostly Mormons, went up the San Joaquin, partly to join Lieutenant Gillespie's party of United States marines and volunteers, in search of warlike Indians, and principally to form a settlement at the junction of the Stanislaus and San Joaquin rivers. On returning, this party stopped to cook dinner on the sand point (S. E. by E. point) of the small island, opposite to what is called the entrance to Stockton, then called Lindsay's Lake. After dinner, one George M. Evans and John Sirrene, now in New York city, commenced to pick yellow specks out of the bank, done them up in paper, took them to San Francisco (then Yerba Buena), tested them with acids, and found it was gold; but not having any idea of the gold being in such quantity as was afterwards proved, put the specimens by, and afterwards part, with other minerals, was sent to Peale's Museum as a present. The reason of my looking for minerals was in consequence of Salvador's death.

5th. The following August (1847), Major Reading and T. W. Perkins and myself, went south from San Francisco, and, being in search of asbestos, we explored the mountains near San Diego and near the River Gila, where we found gold more abundantly than has since been found on the north fork of the American. This is the same place from which the present excitement of "new discoveries of gold in California" has arisen. We could do nothing, in consequence of the Indians being hostile in the neighborhood. The Major lost the chief use of his left arm, while I have yet the marks on my right arm of arrow wounds received at the time. To prove the truth of this assertion, persons in this town can prove that fourteen months since, April, 1853, I told of that same place.

6th. When the Mormon battalion was disbanded in 1847, a number of the Mormons came to San Francisco, and amongst them was one Henderson Cox and one Beardsley, who boarded in the same house with me. They having worked in the Georgia mines, told me, in conversation on the subject, that as they were about prospecting for a road (since called the Mormon Pass) for the Mormons to return to Salt Lake, and in so doing, would prospect the streams in their route (this was in the end of September or first of August, 1847.) I then described the death of Salvador, and where I found the gold, and gave them a chart of the country from memory. In the following January I returned to San Francisco, from the journey above referred to, when I received an invitation to go to Mormon Island, so named afterwards by Henderson Cox. On the 19th of January, 1848, I went there, and with the bounty they gave me, and what I worked out myself, I had $19,000 on the 8th of February, 1848.

7th. On the 9th of February, I, with Henderson Cox, Beardsley, Beers, two Shepards, and a number more, were in the lower end of the mill race, when Marshall, the overseer, and his little girl came in, and the child picked up a pretty stone as she called it, and showed it to her father, who pronounced it gold. He was so excited about it, that he saddled his horse and that day

rode to Sutter's Fort to tell Captain Sutter; but he did not believe it worth notice, and for a while the idea died away. The Mormons, wishing to keep their discoveries a secret from people not Mormons, worked out the gold and said nothing more.

8th. On the 1st of April, 1848, the first mail from San Francisco to Salt Lake was started, and a number of the *California Star* was printed purposely for that mail, containing a special article, written by Dr. Fourgend and myself, concerning the minerals and metals of California, and among other mentioned metals was gold; but, as the printer and publishers were Mormons, the full facts were not stated.

It was not until the 12th of May, 1848, that the existence of gold in quantity in California was publicly made known in San Francisco by Samuel Brannan, High Bishop of the Mormons, and of Vigilance Committee notoriety.

Beardsley and Henderson Cox were killed at the foot of the Sierra Nevada in September, 1848.

Marshall died either four days before he arrived home in the Eastern States with a barrel of gold, or four days from the coast.

As for myself, I still live, but debilitated from the effects of the fever and ague.

To enable persons to test quartz rock who are not mineralogists, I subjoin the rule laid down by James D. Dana, in his "System of Mineralogy." He says:—"It is a simple process. The rock is first pounded up fine and sifted, a quantity of the sand so obtained is washed in a shallow iron or tin pan, and as the gold sinks, the material above is allowed to pass off into some receptacle. The gold is thus left in the angle of the pan by a repetition of the process; a further portion is obtained, and when all the gold has sunk and the sand reduced to a manageable quantity, the gold is amalgamated with clean mercury (quicksilver); the amalgam is next strained to separate any excess of mercury, and finally is heated, and the mercury expelled, leaving the gold."

In conclusion, I have only to say that Johnny Bull, with all his bad qualities, granted a handsome donation to the discoverer of the Australian gold fields; while Uncle Sam has forgot to do the "amende honorable" to the rediscoverers or discoverer of a tenfold value—the California gold.

OREGON GOLD MINES.

A correspondent of the *Portland Times*, writing from Port Orford, under date of July 24th, says:—Various are the opinions respecting the mines on the Coquille, which have attracted the public mind for some weeks past. Many have gone to the mines, and some have returned very much discouraged. All agree that there is gold there—that the diggings are very heavy—some excellent strikes are made, and others entirely fail. From what I hear, I would advise our people to hold on until their wheat crops are taken care of; for, if the mines are really as rich as have been represented, they cannot be soon exhausted, and our bread is more necessary than gold. What I wrote you was from the most reliable persons, and those I deemed the best judges in this place. It may turn out yet to be almost a failure. I hope not; but, at any rate, advise the citizens in the Willamette to hold on awhile. Some of the men now returning bring very flattering reports; others that there is no gold, or but very little. When this difference of opinion will be settled I cannot tell; but, at any rate, I hope the people will hold on a little, so that those so near the mines may have time to settle the matter to their own satisfaction, whether there is or is not gold. Some, I have heard, have already found fault with me for writing; but, I confess, that if the mines are not rich, I am disappointed by those in whom I had confided. From the best information I now have, it requires capital to begin with; and many come almost destitute, and are discouraged at once.

AUSTRALIAN GOLD FIELDS.

The latest reports from these fields are only general in their nature, and represent the yield as very favorable. In the absence of interesting details, it is hardly necessary at present to notice them more at length.

The following paper, read before the London Geological Society, by G. M. Stephen, F. G. S., on "Gems and Gold Crystals from Victoria," is of considerable interest:—

Mr. Stephen gave a detailed catalogue of precious stones and specimens of crystallized gold, obtained by himself in the colony of Victoria, and now laid before the society. In this catalogue, the localities from which the specimens were obtained are given, and the characters of each specimen are described. These gems and crystals were collected by the author in the course of several years' residence in Australia; and the history of each specimen was rigorously investigated. Most of them were sent to Mr. Stephen for examination, or brought direct from the various "diggings," amidst parcels of quartz-crystals (mistaken for diamonds) and other shining minerals, having been found in the "tin dishes" of the gold-diggers whilst washing the soil in quest of gold. The specimens are water-worn, and were generally associated with the following minerals:—quartz, felspar, garnets, tourmaline, augite, olivine, titaniferous iron, oxide of iron, iron pyrites, and, in the case of the specimens from the River Ovens, with oxide of tin, both in crystals, small lumps, and sand. The gems are:—blue and white sapphire, from Ballarat; sapphire, spinel ruby, ruby, and small chrysolites, from Peel River; zircons, spinel ruby, topaz, garnet, and tourmaline, from Ovens River. Mr. Stephen quotes also the following as recorded or stated localities:—garnets, Peel River; garnets and pyropes, Mount Alexander; diamond, New South Wales; white topazes, New South Wales and Cape Barren Island, Bass's Straits; large beryls, Mount Crawford, South Australia; large tourmalines, Encounter Bay, South Australia, and D'Entrecasteaux's Channel, Van Diemen's Land; emerald, Mount Remarkable, South Australia; and opals, South Australia. The author observed, that the conditions under which all these gems were found are similar in Australia and in the countries now supplying them; and hence he infers that the gems of Australia will soon be sought for as articles of commerce.

Mr. Stephen stated, that gold in Victoria was found under the most interesting forms of crystallization, and he exhibited some extraordinary crystals of this metal, both in groups and single, found at the River M'Ivor and at Ballarat. In one group there is a crystal (a cube, with ascending planes, as if passing into the octahedron) which has reached the enormous size of seven-eighths of an inch in diameter. There is also a large crystal, which Mr. Brook, the crystallographer, considers to be a dodecahedron, extravagantly distorted: this is five-eighths of an inch in diameter. Of the several other crystals, some are highly perfect dodecahedrons and octahedrons, with plain and cavernous sides, cubes in different stages of formation, and interlacing (when in groups) hexagonal crystals of transparent quartz.

Attention was also drawn to an interesting macle-crystal of gold, having one pentagon face, with a mammal of gold resting upon it; and to some delicate dendritic gold, which, from its similarity to moss-copper, the author designates "moss-gold." The author stated, that the gold of Australia was often found inclosed in, and inclosing quartz and ironstone, but never, that he had heard of, in granite. The highest standard gold has been found at Ballarat, the M'Ivor River, and the Ovens River; whilst the gold of Louisa Creek, and other localities in New South Wales, was apparently the most alloyed with silver. A sample of gold, coated with a black substance, which resists the acids, and is not acted upon by the magnet, was also exhibited. Other interesting specimens were—a conglomerate of chlorite, quartz, ironstone, and steatite, inclosing gold, and taken, in the author's presence, from

the bottom of a "gold lode," between nearly perpendicular walls of quartz, at a depth of ninety feet, near Mount Alexander; also gold resting upon galena in quartz.

GOLD IN CANADA.

In a letter from Quebec, under date of June 16th, Mr. W. L. McKenzie briefly and summarily states the result of his investigation in official quarters respecting the gold district of Canada:—

When on my way to the Legislature last Monday, I called at the bureau of the Provincial Geologist, Wm. E. Logan, Esq., at Montreal, to inquire of him as to the reality there was in the assertions recently made through the newspapers that there was in Canada East an extensive gold field.

He told me that the gold field extended over ten thousand square miles of country—that a company was working it to some extent—that probably a search for gold there might not reward unskilled labor—and that it is met with, as in Russia, occasionally, along with platina.

I asked to see specimens, and was shown several lumps of the solid metal, weighing over half a pound, avoirdupois, each; also many smaller samples. Mr. L. next showed me a glass jar, with eight or nine pounds of the gold, in little pieces, such as we see in the hands of California miners. I think he stated that there is usually about 12 per cent. of silver incorporated with this gold.

Since I have been here, a friend has told me that Mr. Drummond, Attorney-General of Lower Canada, is one of a company now working these golden treasures, and that his brother-in-law, Mr. De Rottermun, is the manager.

As these gentlemen have the best means of information, Mr. Drummond being a Lower Canada Seignior, I infer that the 10,000 square miles are worth looking at by some of our scientific and practical men—though I advise no one to leave any employment or avocation, in order to dig here.

Lord Sydenham, after getting rid of "the troubles," brought the matter up, and Mr. Logan was employed, with Mr. T. J. Hunt as chemist. Mr. Logan surveyed several counties in Britain before he came to Canada; has long sustained a deservedly high reputation; and any statement from him, in important matters, immediately within his official sphere, would seem to deserve a careful consideration.

The gold-field now worked is on the river Du Loup, a tributary of the Chaudiere, in the Eastern Townships, and about 60 miles from this city, in a south-easterly direction, not far from the main boundary; and I desire the unskilful laborer to remember Mr. Logan's remark, that, in his opinion, such persons would not earn good wages gold-hunting.

The existence of this gold formation has long been known; it is a part and continuation of the same formation in Vermont, which is described by Mr. Z. Thompson, in his work on the "Natural, Civil, and Statistical History of Vermont," and which, in order to present a more complete view of the subject, we here insert:—

It has been known for a great number of years, that we have, in Vermont, a formation agreeing, in almost all respects, with the gold formation in the Southern States, and in many other parts of the world; and it is a well-known fact, that native gold was found here more than twenty-five years ago. The statement, which we published in a note on page 127, Part III., respecting a lump of gold picked up in Newfane, and weighing 8½ ounces, was extensively circulated in the newspapers soon after it was found. Our statement was derived from Gen. Martin Field, who had the lump in his possession. It was a fact well known to us, when our History and Gazetteer were published, that gold had been found in small quantities in the township of Somerset, by wash-

ing the alluvial gravel; but believing then, as we do now, that the success of Vermonters, in digging for gold, will be best secured by observing the Quaker's directions, *never to dig for it more than plough deep*, we took no pains to give prominence to these facts.

What we here call the Gold Formation constitutes a part of what we have been describing under the name of the Talcose Division. It forms a narrow and irregular belt, extending along near the eastern margin of the great division, above mentioned, and reaching through the entire length of the state. Beginning at the line of Massachusetts, in Whitingham, it extends northward, through the western part of Windham county, through Ludlow, Bridgewater, and Rochester, in Windsor county; through Roxbury, Moretown, and Waterbury, in Washington county, and thence through Morristown, Eden, Lowell, and Troy, to the north line of the State. The rocks, which mark the line of this formation, are talcose slate, steatite and serpentine, accompanied by magnetic, specular, chromic and titaniferous iron, also sulphuret and hydrous peroxide of iron. At some places, beautiful specimens of rock crystal occur, many of which are traversed in various directions by hair-like crystals of rutile, rendering them exceedingly interesting to mineralogists. The fine specimens of this kind, which have been found in the drift in the valley of the Connecticut, probably had their origin in this formation. Although, long since, aware of the fact that the formation, in which gold was found, in Windham county, extended through the whole length of the State, we had no knowledge that gold existed in Vermont to the northward of that county, previous to the fall of 1852, when gold was discovered in Bridgewater, Windsor county, by a Mr. Kennedy, and the discovery made known to the public by Prof. O. P. Hubbard, of Dartmouth College. The gold is found there in seams of quartz, and also in alluvial gravel. Sufficient time and opportunity for examination have not yet been had, since the discovery was made, to determine its value. Some specimens of the gold, which we have seen in the quartz, though small, were exceedingly fine and beautiful.

In the neighborhood of the gold in Bridgewater, very fine specimens of galena, or sulphuret of lead, are also found, but we are not informed with regard to its extent; but as Bridgewater is our native town, we hope ere long to have ocular view of the revelations which are being made there.

Although the formation (in which gold is found) may be traced through the entire length of the State, it is not to be expected that gold will be found through its whole extent; nor is it, at present, at all certain that the *placers*, where gold has already been found, will yield gold enough to pay for working. This same gold formation, which passes through Vermont, has been traced from the north line of the State at Troy, nearly 200 miles into Canada. It passes along a little to the westward of Memphremagog lake to Orford, near Sherbrooke, and thence takes a more north-easterly course to the neighborhood of Quebec. Gold was found, in this formation, along the river Chaudiere, as early as 1834, and the discovery was announced in Silliman's Journal in April, 1835. From that time gold was collected there, in small quantities, up to the time of the discovery of gold in California; amounting in the whole to only a few hundred dollars. Since the geological survey of Canada has been in progress, more attention has been given to the subject, and it is found that the auriferous district is quite extensive. During the last three or four years the search for gold has been prosecuted more extensively, and the yield has amounted to several thousand dollars. In Ascot, near Sherbrooke, gold has been found in veins, associated with copper pyrites in a quartz gangue; and it is reported that a lump of gold, weighing 14 oz., was obtained in that vicinity in the fall of 1852.

The steatite, or soapstone, and the serpentine, which we have mentioned, as indicating the line of the gold formation, are, probably, destined to be of quite as much economical value to the State, as the gold itself. The steatite is abundant, and is, in many places, of a very good quality. It has been quar-

ried at Grafton, Bridgewater, Bethel, Moretown, Waterville, and, perhaps, a few other places. The serpentine is largely developed at Cavendish and Ludlow, at Roxbury, and at Lowell and Troy. Much of this serpentine is compact and firm, beautifully variegated with every shade of green, from the lightest tints to an almost perfect black; and, as it admits of a high polish, and is unaffected by heat and acids, it forms a most valuable ornamental marble. It has long been used, to a limited extent, in some of the neighborhoods where it is found, for fire-places, centre-tables, &c., and the opening of railroads, through these several localities, will, probably, be the means of bringing this valuable marble extensively into use.

GOLD IN ALABAMA.

It is now a settled fact that gold may be found in Tallapoosa Co., Alabama, in great abundance. At a place, known as Silver Hill, two veins of gold have been discovered, said, by old gold diggers, and persons who are well acquainted with the mines in California, to be the richest they have ever seen. We have received a letter from an old miner, one who has worked for years in gold mines, and is well known to all of our citizens, in which he says, "Knowing that the whole country is excited upon the subject of minerals, especially gold and copper, I thought that a communication from this place, where both may be found in great abundance, would be interesting to your readers. I have worked in the richest mines that have ever been discovered in Georgia, when they were at their best, but I have never found any of them that would compare with the mines which we are now working. It does an old miner good to sink the pick when so much of the precious metal can be turned up for each blow.

"I am one of the hands that pounded twenty bushels of the ore, on yesterday, from which we got twenty-eight pennyweights of pure gold. Why should we go to California or Australia for gold, when we have it here in such abundance? I am confident that we can take out a million of bushels from the same tunnel that this came out of; and in another tunnel, which is now progressing, we find it in large quantities, and equally as rich.

"I have stated nothing here but facts. Not being interested in the mines, I would have no inducement to do so. If any one, however, doubts my word, a visit to this place will show them that, so far from exaggeration on my part, the mines are far better than I have described them."

VIRGINIA GOLD.

The *Philadelphia Ledger* has been shown a lump of gold gathered from the mines of the State Hill Company, at Louisa, Va., the proceeds of two weeks' labor, which is valued at $700, and cost, in the production, about $400, giving about $300 profits for the two weeks. The prospects are quite encouraging, both as regards the quantity and quality of the gold produced.

GOLD AMALGAMATORS.

A. S. Wright, of San Francisco, Cal.: I claim the method described for amalgamating gold in hollow revolving cylinders upon horizontal axes, said axes, journal, or trunnion being hollow to admit the pulverized quartz or ore from one cylinder into another, the inlets through the trunnion being smaller than the end of the outlet; the said cylinders connected by flanges or pipes with grooves turned into the axes or trunnions, and rings fitted into the grooves and covered by the flanges; the whole being so connected as to make them water or steam tight, and so arranged as to give a fall of about six inches to each cylinder, said cylinders containing rollers, knives, burnishers, and other analogous arrangements to produce friction, scour the ore, and produce the amalgam with quicksilver, the whole arranged and combined, as set forth.

REPORT OF THE ROCKY BAR MINING COMPANY.

NEW YORK, *September* 15, 1854.

The Board of Directors of the Rocky Bar Mining Company, having felt it needful to call upon the stockholders for an assessment of two per cent., present the following statement of the affairs of the Company, for their consideration.

The present Board, on assuming office, levied an assessment of five per cent., which, if paid, would have realized $36,635, and was stated by them as sufficient, in their opinion, to put the Company in full working order. To meet the convenience of many holders this amount was reduced to three per cent., calculated to produce, if paid by all, $21,981; of this amount, the sum actually received only amounted to $14,421.45, leaving 50,397 shares unpaid on, and which have, therefore, under Article Seventeen of the Articles of Association, been declared forfeited to the Company.

The number of shares issued is now only 96,143, representing, at par value, $480,715. The balance of the above capital is available for the purposes of the Company, or, if retained as it is, will increase the proportion of any dividend, or other advantage, to the present holders of the stock, whose interest in the undertaking has more than doubled since the first assessment was levied, in consequence of the operation of the forfeiture of stock.

A reference to the capital account will show the various heads of expenditure. Mr. Seyton, our engineer, has decided to pump our claims, and has purchased a pump capable of discharging 250 gallons per minute. He has arranged with the Agua Fria Company, and other claimants, to pay him $1.50 per ton for every ton they get out of claims drained by our pump, and also, $1 extra per ton, for any quartz hoisted by our engine. He also expects to sell or use the water, as it is most valuable to the miners, and, indeed, is the great want of the district to surface miners.

This will be a source of revenue quite independent of the assumed profit to be derived from getting out our own quartz; and the water will be available, also, to sluice the surface earth on our own claims, which at present we cannot do for want of water.

The revenue account shows the amount received, chiefly from surface washings, which have been suspended during the dry weather, but will be renewed next winter, when the rains set in, or if we procure a supply from our engine-shaft.

The balance-sheet will show that, after providing about $1,500 more to Mr. Seyton, which he has to pay for the pump and other items, our available means are again exhausted. We have everything now on the ground ready to commence active operations, and all paid for. We have no debt against the Company, and it is our duty as Directors, under Article Six of the Articles of Association, to see that "no officer, stockholder, or member of said Association, creates a debt against the Company for any purpose whatever."

By this, as Directors, we intend strictly to abide. We will not be parties to borrowing money, or mortgaging the undertaking. In the present position of monetary affairs, we cannot hope to realize a sufficient amount from selling the forfeited stock, and the only mode we have open to us, is again to avail ourselves of the power granted in Article Seventeen of the Articles of Association, viz.:

"The Directors, for the time being, shall have power to levy assessments, *pro rata* upon each share, in such sums as shall be necessary effectually to carry out the objects of the Association."

From the estimates of Mr. Seyton, we have no hesitation whatever in saying, that if the present assessment is paid by the existing holders, we are perfectly certain to accomplish the effectual draining of Massachusetts Hill, and thereby lay open what we have every reason to believe to be the best quartz vein in Grass Valley, and at once to bring our undertaking into profitable operation. If the Directors are supported in this matter, they pledge

themselves to carry on the work with energy; but if not, they are perfectly willing to resign their posts into other hands, or to make an immediate sale of the property and close up the Company.

It will be apparent, however, that to do so at present would be sheer folly, after all our sacrifices and exertions, as we have now overcome every difficulty and are near success.

Negotiations were attempted to be entered into with the Agua Fria Company, by the president, during his stay in London. He was met at all times in the most friendly spirit, and though nothing definite was arrived at, it is so evidently the mutual interest of both companies, that it is hoped some basis of agreement may, ere long, be entered into.

The Directors subjoin the advices from Mr. Seyton lately received; the last communication from him being to the 14th August, and also his account to that date. His previous statements and accounts have been so fully published and circulated amongst the stockholders, in the monthly reports published, that it is needless for the Directors further to enlarge upon them. It has been their desire to give to the stockholders all the information in their power possible, to aid them in forming a judgment on the property, and regarding the progress of the work, and they desire to continue the same course for the future.

"14th JUNE, 1854.

"I have agreed with the Gold Hill Company to have the use of their double-flue boiler (a very good one, and which will insure me a plentiful supply of steam) on Massachusetts Hill, till 1st April, 1855, with the option of purchase, at any time for $1750, else to be returned on or before that date at their works here. They are to have the crushing of our rock, provided the rate is made satisfactory to me. If I cannot have a mill myself, this is the cheapest and best way I can have the work done. Thus you will perceive that I am ready to commence at once. I have had proposals for sinking and timbering the engine-shaft; but I think better not to accept any at present.

"The cost of sinking engine-shaft ninety feet, (shaft to be, inside timbers, nine feet by four feet,) and timbering all the way, will be about $900; cost of shears, blocks and tackle, and building, say $1600; and for removing and placing engine and boilers, $1000. This (which does not include wages for blacksmith, or occasional labor) will be about the expense necessary to incur before I can get to work."

"JULY 31, 1854.

"I have made a contract with the Agua Fria Company, as lessee of the Nevada Company's claims, by which they agree to give me, as compensation for pumping, $1.50 per ton of rock raised by them, and $1 (in addition) per ton, for every ton hauled for them through our engine-shaft. The other claimants have not signed any agreement yet, but have given me to understand, that they will pay either $4 or $5 per claim per day, or otherwise contribute their fair quota, either in money or labor. I cannot either buy or lease their claims; the latter arrangement they will not agree to; and the price they ask is far beyond my means, and even beyond what I should consider a fair price, if I had surplus funds at command."

"14th AUGUST, 1854.

"The pump and machinery are all finished, and in the Valley, (with the exception of a few lengths of the discharge pipe.) The last teams came in to-day, and the last one is now unloading. There is no occasion for any delay now in opening the mine, except such as arises from a deficiency of funds in hand, to pay for lumber and wages. I have a sufficient supply of tools of all kinds, for some time to come; an engine in good order, a boiler of sufficient capacity, and as good as the engine, (as far as I can see its qualities in its present position,) the pump and connecting machinery on the ground, and the necessary arrangements with the other claimants made as well as can be expected. I shall now be obliged to wait till I have a sufficient

supply of funds to commence the engine-shaft, and place the engine and machinery. As I am of opinion that it would be most injurious to the whole operation, to commence with the prospect of having to stop for want of money, I shall (unless otherwise instructed by you) wait until the necessary supply is sent. I have been enabled, thus far, to go on surely; but I should not *deserve* success, if I were to compromise my chance of it by a too hasty progression, now that I have all the wants and appliances collected and at hand."

The following are the sums received and expended, on the Company's account, by Mr. Seyton, from 12th April, 1854, (date of last published account,) to 14th August, 1854:—

RECEIVED.		EXPENDED.	
Balance on hand 12th April, as per last account, . .	$3,274 20	Tools, Instruments, Stationery, ...	$1,110 81
Drafts from New York, . .	3,600 00	Lumber, ...	250 00
Assessments paid in Grass Valley, ...	6 15	Wages, ...	777 75
One-fifth net earnings of Gold Hill Sluice, to 2d May, .	48 46	Office Expenses and Advertising, ...	68 25
Gold from Wolf Creek Sluice, to 14th May, . . .	112 85	Paid on acc't Pump, $2,000, Freight and Teaming, $409.43, ...	2,409 43
Cash for old iron sold, . .	25 00	Salary, Board, and Travelling Expenses, ...	1,747 62
	$7,066 66	Balance, 14th August, 1854, .	708 80
			$7,066 66
		Balance as above, . .	$708 80
		Remittance not yet acknowledged, not included above, . .	500 00
		To be accounted for, .	$1,208 80

By order of the Board,

M. BRENAN, *Secretary.*

JOURNAL OF COPPER MINING OPERATIONS.

LAKE SUPERIOR REGION.

The shipments of copper to the 23d of August, from the Lake Superior region, for the season, amounted to 257 tons, 1,853 lbs. of copper.

A comparison of wages and prices of the present year with the last is made by a writer at the mines, whose communication contains the following important statements:—

The mines that are producing copper find the increased value of that metal in the market to be as great and even greater than the increased expenses of raising it. It is only about two years since refined copper brought only seventeen cents a pound.

In the spring of 1853 it rose for a moment to thirty-two, and fell back to twenty-four to twenty-five cents, the average of the previous year being about twenty-two cents.

The average of the past year has been about twenty-seven cents, or a permanent advance of five cents per lb., which is $100 per ton.

The shipments last year were a little short of 3,000 tons mineral, producing about 2,000 tons refined copper. On this the increased value of last year over

the previous one was not far from $200,000; and of the third year previous, or 1851, $400,000, or double.

The advance in copper during four years is therefore thirty-seven per cent.

Let us see if the entire expenses attending mines this season are full twenty-five, if not thirty-seven and a half per cent. higher than they have been heretofore for at least four years.

If the agent of the Cliff and North American mines can be received as authority in their own business, they are paying for mine work less, and for most of their surface work no more than they were last year.

The cost of supplies and transportation is materially increased. New mines not yet producing copper feel this rise sensibly. But the stockholders are sensible that this increase, which must be temporary, is less injurious to their interests than would be the abandonment of the works till times and circumstances change.

The country was never so well filled with miners, and mine work is done at reasonable rates, as any persons of judgment will see by merely examining the works thoroughly.

At the opening of spring, as usual, surface men were scarce, and were able to obtain high wages for a limited period, particularly at the small mines. The present rates for surface hands are twenty-six to twenty-eight dollars for ordinary men, thirty dollars for teamsters, and thirty-two to thirty-four dollars for extra good hands. They pay ten dollars per month for board, on which the companies who furnish the supplies, owing to the rates of provisions and freight, lose from one to three dollars a man.

A man and his team of horses receives five and six dollars per day. These are the prices on Point Keweenaw.

Last year the prices ranged from 75 cents per barrel in midsummer, to $1.63 in the fall. This is from Cleveland and Detroit. This year they were raised from $1.25 to $1.60.

The North Western Company made their report on the 6th of May, 1854; the superintendent therein states, that the average wages of all surface hands and mechanics, for the previous year, was $21.12 per month clear, and of miners $30.46. The Copper Falls Company reported, on the 1st of the month of April, the average wages of miners for 1853 at $34.58, which is less than their earnings of the previous year.

All those who have in view actual mining business, and not mere *stock operations*, will perceive that if their mines are ever destined to pay, there never was a more encouraging time to prosecute their works than the present.

Copper is high and likely to continue so, labor is not extravagant, and freight during the coming year must be reduced to sixty or seventy cents per barrel. What provisions will be cannot be foreseen, but they will not in all probability be any higher.

MINING PROSPECTS.

The following remarks by the *Lake Superior Journal* present, in a few words, some important particulars relative to the present operations and prospects of various companies on the shore of the lake:—

The news from the mining country generally continues to be of the most encouraging character, though, as we have before stated this season, the principal mines, those that are paying dividends, or those rapidly progressing to that important point, are worked with increasing energy and with a more free expenditure of means than the new concerns. The old mines have their machinery erected and their grounds extensively opened, and can afford to prosecute the business with the utmost energy. It is not so, however, with new concerns; with the certainty of the opening of the ship canal at this place early another season, and the equal certainty of prices of transportation to and from the mines being reduced to one-third or one-fourth of present rates,

and with the prospect of no little reduction in the prices of labor, new mines are being worked with reference to that new era in the mining business, when their expensive works can be carried on with far greater economy than at present.

Numerous companies are simply preparing for the business, exploring thoroughly their locations, clearing off their lands, and laying the foundations for extensive mining operations. Many will order engines this year, which will be ready for shipment from the engine works directly to the mines, another season, with only one shipment, thereby saving immensely on the cost of such machinery. The expenses of mining will be reduced in a thousand ways another year, and it is generally considered prudent to move with their works with as little expense as possible. The influence that the opening of this canal is destined to exert on the mining and all other kinds of business of this inland sea, must be immense. Not till then can the iron business be said to have commenced, and not till then will the wealth of the copper mines be understood and properly valued.

The numerous visitors to the copper region have furnished a flood of correspondence respecting the mines, which, although not designed to be of a strictly professional stamp, is yet interesting as showing the impressions of those not confined to the wearisome and dangerous labors of the miner. For this, and similar reasons, we have at present gone more at length into this species of reports from the Lake Superior Copper Region. The general reader will find therein much to reward his attention.

A party who have been spending the past four or five weeks in the mineral region of Lake Superior, have just returned, in conversation with whom the following information was given to the editor of the *Detroit Advertiser:*

They say that the village of Ontonagon has much improved since last season, and quite a speculative spirit is manifest in village lots; that the plank road being constructed from Ontonagon to the mines, is progressing rapidly to completion. About nine miles is already completed, and the whole grubbed and graded nearly to the Toltec mine. That the mines, generally, in that region are all looking well, and improving as the working of them progresses. Many of the new mines have but few men employed on them, but sufficient to explore and open their veins preparatory to working large forces on the completion of the Saut canal, when men and provisions will be obtained at much less rates than at present.

The *Minnesota Mine* is taking out about seventy tons of copper per month, and employs about three hundred and fifty men.

Rockland Mine adjoins on the east, and carries the same vein. The work of mining is progressing rapidly, in running adits, sinking shafts, &c., ("opening the mine," as it is called,) in doing which large quantities of copper are taken out.

Flint Steel is next east of the Rockland, both of which were formed on lands belonging to the Minnesota. The work of opening the mine is vigorously prosecuted, and large quantities of copper are taken out.

Nebraska Mine, next adjoining on the east, have a fine show, and have commenced driving an adit into the bluff, from which, and from an ancient pit, they have taken out a quantity of native copper.

Evergreen Bluff Mine, half a mile east, which our informers particularly examined, being interested, they say that the work of opening and developing the mine had been judiciously and satisfactorily prosecuted by Mr. Sales, the Superintendent, who has recently added to the force employed, and recommends a large additional force in the fall, for winter operations. That the adit which runs in from the eastern end of the bluff, and about one hundred

feet below the summit, was extended in one hundred and twenty feet eight inches, when a mass of native copper was struck, which they were unable to start from its bed by blasting, when it was determined to sink a shaft from the surface to enable them to prosecute the work more successfully, by having ventilation, &c. Accordingly a shaft has been commenced about twenty feet beyond the end of the adit, in sinking which, within six feet of the surface, a barrel of small lump copper was taken out, and they were subsequently informed by the Superintendent that the next day a mass of pure copper weighing eighty pounds was taken out not eight feet from the surface. In the adit, on either side and top, native copper is to be seen throughout the entire distance, and within twenty feet of the mouth a mass presents itself about five feet long and three feet thick. Sixty feet south of the adit another vein crops out, which runs parallel with the adit, which it is the intention of the Superintendent to cross cut into from the adit one hundred and forty feet from the entrance. The stamp copper taken out is exceedingly rich, though not now available, since they have no stamp works erected. The native copper is interspersed with small lumps of native silver, while some of large size have been taken out, specimens of which were shown us. It is expected that, as the shafts are sunk to greater depth, the precious metals will be found in greater quantities. This is the character of all the Ontonagon district; but the only one producing silver, in quantities sufficient to mine for, is the Minnesota, they having attained a greater depth than any other mine.

The *Ridge*, adjoining on the north, and the Adventure, Merchant, Ohio, Aztec, and Piscataqua, on the east of it, are all progressing in the work of opening their mines, and encouraging prospects are before them.

The *Toltec Mine*, about a mile northeast of the Evergreen, has a large amount of stoping ground open. This mine has an engine of eighty horse power, now at Ontonagon, which will be put up on their location during this fall, and when in operation, will turn off a large amount of copper from their stamps. This mine is under the superintendence of Mr. Sales.

The *Algomah Mine*, adjoining on the east, is a new mine of much promise. Their vein is exceedingly rich in stamp and barrel work, and mass copper.

Indiana Mine, about a mile further east, is a new mine, which, for the time it has been worked, has more ground opened than any in the district, and the veins look exceedingly well.

Fire Steel Mine, adjoining on the east, a new mine, is opening large and promising veins.

Douglass Houghton Mine, adjoining on the northeast, is in a very prosperous condition, and gives promise soon of amply repaying the shareholders for their heavy outlay. They have made large shipments of copper for the present season, and still have a large quantity ready for shipment. They have, perhaps, with one exception, more stoping ground opened than any other in the district. This mine is under the superintendence of Mr. Joseph Coulter, a gentleman of much experience in Lake Superior mining.

Buffalo Mine, half a mile north, is a new mine, the working of which has just been commenced under the superintendence of Mr. Martin Beaser, an old resident in the district, much experienced in mining. The vein, as far as opened, looks well.

El Dorado Mine, adjoining on the east, is owned by a company just organized, on lands pre-empted by Messrs. Berry and Gremer, of whom it was recently purchased by an association of gentlemen of Ontonagon and Detroit. The vein of the Buffalo has been opened up to the line of this location. Two other veins were examined by them on this location, both of which were well defined; one of them about two feet wide had been dug out with a pick-axe at the end of the bluff, and the walls on either side were as even as though made by artisan hands. Operations are to be commenced on the location without delay.

The party, after returning to Ontonagon, proceeded up the lake, in an open boat, to Montreal river.

The only mining company yet organized on this river is the Cambrian.

Of the same class is the subjoined description of a tour through the entire mining range. Perhaps, as a connected discription of the objects which meet the eye, and of the present aspect of mining operations in the Lake region, it is more complete than any other recently made. As such we insert it here from the *Detroit Tribune*:—

The *Toltec Mine* is about 16 miles south-east from Ontonagon. In the course of next summer they will have a good plank road finished to the mine. In the present state of the road the only speedy, safe, and sure passage is to embark afoot. On the 17th of June, at 9 A. M., I left Ontonagon and reached the Toltec at 2½ P. M. The road was always in a most wretched state. I was very happily disappointed in the appearance of the mine. It is situated in a fine agricultural country, having about thirty acres under a good state of cultivation, and the buildings of the most approved order. The workings are situated in a bluff, or high ridge of land in this clearing, and are much more extensive than I had expected. They have sunk four shafts, the deepest of which is 250 feet, reaching to the fourth level, all of which are connected with the shafts.

For a better understanding of the manner in which a mine is worked, and the terms usually employed in mining parlance, I will observe, *en passant*, that a *level* is a horizontal tunnel following the vein, and these levels are about 60 feet apart, one above the other. The making of these levels is called *drifting*. *Stoping* is the taking out the vein between these levels. A *shaft* is a perpendicular tunnel sunk upon the vein at different intervals along its course. This vein of the Toltec is looking remarkably rich, and the mine is well opened. Considerable copper in mass is laying in the drifts, and the lode is well filled with barrel and stamp work. They are getting out the timber for their stamp-works, and when they are erected and in operation I have no doubt they will commence shipping copper in large quantities. The Algomah Mine is situated on the eastern extremity of the Toltec bluff, distant about half a mile, and is supposed to have the same vein. But little has been done here compared to the Toltec, though the lode is looking rich—the mine is new. The Douglass Houghton, Fire Steel, and Indiana I found looking remarkably well. The workings upon the Douglass Houghton are quite extensive, over 50 men being engaged on the location, and their prospects are very flattering. For new mines, the Fire Steel and Indiana present a remarkably rich appearance. These mines are situated five or six miles east on the range from the Toltec. Going west on the range you fall in with the Merchant, Adventure, Ridge, Evergreen Bluffs, Nebraska, Flint Steel, Minnesota, and National. These mines lie directly on the route, and are all situated on the east side of the Ontonagon river, and for an individual who is taking his "views afoot," serve as convenient and desirable resting places on the route. The Adventure Mine is worked on the east end of a bluff some 250 feet high, and is looking well. The Merchant is progressing steadily, and is now opening a new vein with flattering prospects. The Ridge has done considerable in the way of mining, having raised considerable stamp and barrel work. They have just got their stamp works in operation, and it is expected that the mine will now pay its own expenses.

The *Evergreen Bluffs Mine* is opened on the east end of a bluff, by drifting in upon the vein 125 feet. It presents fine indications, and is no doubt a rich vein. The mine is new, and of course but little has been done; enough, however, to place it among the first of the new mines in that part of the range.

The *Nebraska* is also a new mine, just commencing, and presenting somewhat the appearance of the Evergreen. Both of these mines have been

the location of ancient Indian diggings. Places are to be seen near their drifts, where the Indian, in times past, has endeavored to hammer away the rock around a piece of copper, which still sticks into the rock and defied his skill and efforts to get it from its place.

Flint Steel.—This mine is situated in the Minnesota tract, and no doubt is destined to be what is termed a mass vein. A level of 350 feet has been opened on the rim, producing rich stamp, barrel work, and mass copper. A mass of two tons is now lying at the end of the drift. A small force only are at work upon the mine, and their surface improvements are very limited.

Minnesota.—This indeed is a master mine, their vein is a master vein. Mass after mass, weighing thousands of pounds, are being lifted to the surface, and the supply seems to be inexhaustible; down, down into the depths of the earth upon this vein one mass after another is being uncovered—so ponderous, so vast in its dimensions, that it must be cut in the mine into a dozen pieces before it can be lifted to the surface, and then it comes up, hoisted by steam, in blocks of five and six tons each. These works are of course very extensive, employing a large number of men.

National.—This mine lies west and near the Minnesota: they are working between 90 and 100 men. Considerable mass copper is also taken from this mine, as well as rich stamp and barrel work. It bids fair to stand in point of value next to the Minnesota.

The country through which this mineral range passes, or upon which the above mines are situated, possesses rich agricultural qualities. Farming, to a greater or less extent, is carried on at the different mines, and the labor of the husbandman is richly paid. The workings are situated upon high bluffs or elevated pieces of ground—not because the veins do not exist in the level lands, but in these bluffs there are large quantities of outcrops of ground, or in other words, an exposure of the bare rock, and in these places the veins are first discovered, and mining commenced. These bluffs vary from one-fourth to a mile in extent, sometimes longer, by one-fourth to half a mile in width, and generally run east and west by south. These elevations are situated upon an elevated slip or belt of land two, three, and four miles wide, running parallel with the lake, and about 13 miles from its shores, and this is what is termed the "Mineral Range."—As a general thing these bluffs are precipitous and outcrop on the south side, gently descending to the north. The lands surrounding these, and even upon their summits, are of the first quality of agricultural soil, and wherever the farmer has cultivated it, and attended to his agricultural pursuits, the profits of the first year's crop has paid him for his improvements.

I have now brought you to the Ontonagon river in our journey westward. After crossing this stream, which is a broad, deep, and rapid river, the first mine we come to is the Arctic. This is a new mine, started about two months since, and their agent, Mr. Voorhees, has displayed an energy and perseverance which few new miners can boast of. He has already nearly thirty acres of land cleared, and substantial buildings erected. There are three veins upon this location, and the one which they have opened presents a very fine appearance. There is every indication and encouragement that this will make a good mine. The Cortez lies just west, and within a stone's throw of the boundary line of the Forest. Upon this mine but little is doing at present. The Glen and Forest veins cross their location. The Forest mine is situated upon the north side of a bluff about two hundred feet high, and upon an elevated plateau of 700 feet. The view from this bluff is most extensive and picturesque. The lake fifteen miles away is plain in view; the surrounding hills and valleys, for miles in extent, present a beautiful landscape. As you look across the valley to the opposite hills you see the buildings and clearings of the National mine, three miles away, as though they were within speaking distance. The mine is looking well and the work being carried on vigorously—two hundred men are employed in and about the mine. It is situated about two miles from the river; from thence to the mine is an elevation of about six hundred feet.

They are now cutting out a track for a railroad from the mine to the river, where their new stamps and saw mill are being erected, and where the copper is shipped. The cars are to be drawn up by a stationary engine.

The *Glen Mine* is situated just south, and a short distance from the Forest. Considerable activity prevails here, and they are at work on a very rich lode. Everything warrants complete success for this mine.

We now go to the *Ohio Trap Rock.*—This mine is situated between six and seven miles west from the Forest. The country over which the trail passes abounds in mineral. Beautiful bluffs rise up here and there along the route, but no mines are at work upon them. The *United States* location, which was unsuccessfully worked in former times—in the days of leases—has been abandoned. There is no doubt but what it is a good mineral tract; but mining was then in its infancy, and they became too soon discouraged. This company evidently commenced in a wrong place upon their tract.

We now arrive at the Ohio Trap Rock, situated upon the north side of a bluff, some 300 feet high. This mine has labored under many difficulties, and the energy and perseverance with which it has been pushed ahead under discouraging circumstances redound much to the credit of the agent and directors of the Company. They are now to reap the fruits of their perseverance. The vein is looking rich, and yields well in barrel and stamp work. They have completed between 700 and 800 feet of drifting, have 24 head of stamps going, and a good saw-mill in operation. The location presents quite a scene of activity, and what is not to be met with elsewhere on the range, is a good frame meeting-house, painted white, and looking very respectable. We now go to the south side of the same bluff, and there we find the Windsor and Norwich mines.

This bluff falls perpendicular on the south—look up to its towering summit—see those cragged rocks overhanging along its side. Up that steep ascent, two-thirds of the distance is the vein of the Norwich mine. A drift enters the base of the bluff and strikes this vein at a distance of 509 feet—here is the third level. The levels in this mine are about (200) two hundred feet long. The vein is rich in stamp-work, and is said to be the richest in the country. Considerable mass and barrel-work is also taken out. There is no doubt but what this is destined to make a rich mine. It is pushed ahead vigorously, 75 men being engaged in and about it. They have just erected their stamp-works and saw-mill. The Windsor mine is situated upon the same bluff, just east, and working the same vein. They are now drifting into the base of the bluff, and will strike the vein at the third level, in 573 feet. Their levels are about 300 feet in length. The force upon this mine is not as large as that upon the Norwich—are working 22 men; the lode is good, and presents pretty much the same appearance as at the Norwich. Going west, we next come to the Hudson, a new mine, working a small force upon what is supposed to be the Ohio Trap Rock vein. It looks well, and the prospects encouraging. We next come to the Pittsburg; nine men are employed upon this mine. They are now sinking upon a shaft to strike a vein which presents very good surface indications. They are down about 75 feet, and expect to reach the vein in 20 feet more sinking.

Clifton.—This mine was started last October, and has been carried ahead with considerable industry; good buildings erected, and about six acres cleared. They are working on two veins, both of which are looking well. The show is very favorable, and presents every appearance of making a good mine.

The *Sharon* is also looking well. They have three veins upon this location; the north and south ones are supposed to be the Trap Rock and Norwich. The south vein is very rich with stamp-work. They are working six mines, and employing 20 men upon the location; have about fifteen acres cleared, and good log-houses erected. So far as these veins have been opened, they present a very encouraging appearance.

The *Metropolitan Mine* comes next in our course westward. This mine

has just commenced operations, and the vein which they are sinking upon, presents all the appearance of a master vein. I will venture to say that there is not a vein west of the Ontonagon river which presents the richness which is to be found here. It is of quartz and spar, about one foot and a half wide, situated upon the south side of a bluff, and running with great regularity. The lands through which this vein passes have risen in value since the commencement of the workings here.

The *Ward Mine* lies next in our westward course, but has not yet commenced operations. They have the Metropolitan vein. The Derby, Magnetic, and Gogebic are looking well, and are the pioneer mines of the West. I have now brought you over about thirty miles of the range; beyond is an unbroken wilderness, but the same formation, the same range continues. In your route thus far, you have received the hospitalities of the miners—their doors have been opened to you, and their kind welcome has greeted you at every step—but westward the scene changes—your blanket and your provisions must be placed upon your back, and you proceed on your journey, the sun, the compass, or the lines of the surveyor being your guide; where night overtakes you, you light your fire, eat your hard bread and ham, roll yourself in your blanket, and take your rest. Through swamps, over hills, and across rivers you keep your course. He alone who has been upon such a journey can judge of the fatigues and hardships of the undertaking.

Six or seven miles west of Gogebic mine, lies Lake Agogebic, a beautiful sheet of water, about two miles wide and twelve in length: the country about it is hilly, and the lake is bordered with a beautiful sandy beach. Here, around this enchanting spot has been for ages the home of the red man. Here he makes his sugar, traps his beaver and otter, and kills his game. Here is the home of his youth and the graves of his fathers.

Westward as you pass along the range, you are at one time climbing the beautiful bluffs, then again picking your way through the densely-timbered portion of the level lands along your route. From Gogebic to the Black river, the range is uniform and regular, but the bluffs are not as high as the eastern portion. It frequently sinks away and is lost entirely in the level lands, but rises again and goes regularly westward. Many valuable veins have been found in this portion of the range, and this part of the country is now attracting considerable attention. I have now brought you thirty miles further in our westward course, over hills, through bottom lands and swamps, and we now stand upon the banks of Black river, thirteen miles from Lake Superior in a straight line, and twenty-five or thirty by the river.

From Black river to the Montreal river, a distance of twelve miles, the bluffs on this range rise to a prodigious height; the veins are all large and run with great regularity, and the level lands of the first quality for agricultural and mineral purposes. Having now brought you to the boundary of the State, which at this point is nearly 150 miles west of Chicago, I will not trouble you or your readers with a description of my journeying eastward.

I cannot close this already overgrown communication without speaking in the most approving terms of the energy, perseverance, and rapidity with which the Ship Canal is being constructed. The whole line seems to be alive with workmen, and nothing lags. I was astonished as well as agreeably surprised to see the progress which had been made during my absence. It is evident that the Company are determined to finish it within the time prescribed, and when completed, it will be the most magnificent work of the kind in the Union, if not in the world. It will be an honor to our own State, and a credit to those who have constructed it.

Both of the locks are nearly completed, and when finished will present a splendid piece of mason-work. In the construction of this work, the Company have had to labor under, and encounter many difficulties and disadvantages; for most, if not all of the material, is brought from a great distance; but their energy and perseverance has overcome every obstacle. The order and

regularity with which the work is planned and executed, show that a master workman is over the whole. The enormous stone of which these magnificent locks are constructed, are all hewed, squared, and numbered in the quarries at Marblehead, Ohio, and Malden, C. W., and brought in vessels to the foot of the rapids. The timbers are conveyed in floats from a distance. In fact everything used in its construction is brought from abroad. With all these difficulties to encounter, the work is progressing to a speedy termination, and I should not be surprised if a boat passed through the locks this fall. The line of the canal presents a busy scene, some nine hundred men being engaged on the line of the work. When night comes, they do not entirely abandon their labor. Torch fires are burning and the busy work is going on at different points. With energy, perseverance, order, and system going on like this, what cannot be accomplished?

TOWANDA MINING COMPANY.

The property of this Company is located in Bradford county, Penn. The Company is organized under the law of New York, with a capital of $600,000. The office is at 110 Broadway, Messrs. Bronson, Knapp & Co. The following is the report of Mr. A. Partz to the proprietors, on an examination of the property:—

Gentlemen: Agreeable to your request I have made an examination of the late Carpenter Mine, now called the Towanda Copper Mine, in the township of Albany, Bradford county, Pennsylvania. This mine is located in the underlaying Devonian rocks of one of those detached areas of the carboniferous formation, which remain, east of the great coal region, along the Susquehanna river. It consists of a copper-bearing gray clay shale strata, which measures from 2½ to 4½ feet in thickness, and forms the base of a hill about 100 feet high. This strata is exposed in a small ravine, excavated by a branch of the Towanda Creek, on the north-east side of the hill, where two level adits, 20 and 30 feet long, are driven into it. Although this work could have been performed with more judgment and to greater advantage, it serves to form some idea of the wealth and value of this interesting deposit, which is probably the only one of its character opened in the United States.

The strata lies almost horizontally, dipping only a few degrees west or south-west, and the whole of it is interspersed with copper ore. However, there is a seam on the bottom of it, varying from 4 to 16 inches in thickness, and averaging about 12 inches, which should be regarded as the principal object for a mining enterprise. This seam contains a considerable quantity of the black oxide and also carbonate of copper, besides numerous nuggets of gray copper ore, and occasionally some native copper. It carries a string of soft reddish "flookan," and the rock, which resembles graywacke slate, is abundantly interfiliated with lignite, representing the forms of branches of trees. There is a kind of a foot wall, about six inches thick, consisting of a compact limestone conglomerate, which also contains oxide of copper and shows some fossil remains. A red clay shale strata over and underlies the copper deposit.

Analyses of ores, taken from the seam referred to, have been made by different parties, who obtained 20, 26, and 34 per cent. of copper. A lump of gray copper ore gave 56 per cent., and a box of (average) ore, smelted in Baltimore, yielded 44 per cent. An assay of the poorest kind of ore, from the upper part of the copper-bearing strata above the seam, gave 3.15 per cent.

In order to decide upon the value and workable qualities of this mine, a comparison of the same with a similar kind of copper deposits in the county of Mansfield in Germany, will be somewhat instructive. The mining of these deposits is considered to pay well, by a yield of 4½ per cent. of copper, and even ores, which yield only 2 per cent. beside a very small per centage of

silver, are mined with profit. The copper strata is so narrow, that the works are mostly less than two feet high, and the miners are bound to win and haul the ore in a laying position, sometimes seven inches in water.

Considering, even, that labor and other expenses are here four times dearer than in Germany, there can hardly be a doubt that the Towanda Mine could be worked to great advantage. Its position is highly favorable to mining operations. The ore can be carried out from the workings to the grass without any hoisting, and the mine can be kept dry by very simple means. Neither preparatory works nor expensive machinery is needed, and ore is extracted from the very start of operations. For crushing and dressing the ore, a fine water-power near the mine will do all that is wanted. A very simple and cheap apparatus for the concentration of ores, which has lately been invented, would here be of great service.

The tract of land, on which the Towanda Mine is situated, embraces 725 acres, about 50 acres of which are cleared and under cultivation, the rest being well timbered. The copper-bearing strata appears to underlie the whole tract; I found it cropping out on the opposite side of the hill, about 1¼ miles distant from the present openings. It is highly probable that it will increase in richness by farther extending the works into the hill.

The Towanda Copper Mine lies 12 miles from Towanda, the county seat, which place is touched by the north branch of the Pennsylvania Canal; and it will be within half a mile of the Northern Pennsylvania Railroad, which has been located, and the construction of which will soon commence.

In conclusion it is my opinion, that the small outlay of capital, needed for the development of this mine, by a proper management and the necessary mining skill, would be handsomely repaid by early returns.

I am respectfully yours, AUGUST PARTZ,
Mineralogical Chemist, and Geologist.

EAST TENNESSEE COPPER MINES.

The importance and value of the East Tennessee mines has already attracted attention. A correspondent of the *Savannah Courier* furnishes the following additional facts:—

Ducktown is the name given by the Indians to a small stream or creek, having its source in the mountains, flowing in a south-west direction into the Ocoa river, near the Georgia line: it is on the waters of this stream, covering an area of twenty-five or thirty square miles, in one or two miles of the Georgia and three or four miles of the North Carolina line, that the Ducktown copper mines are located.

The first shipment of copper ore was made by the Hiwassee Mining Company early in 1852. Since then, and up to the first ultimo, six or seven other companies have made shipments, and many more are and will be ready to ship during the present year. The annexed particulars, furnished me by the obliging and gentlemanly proprietor of the Murdock House, at which I am stopping, will give some idea of the mines. They are taken from a statement furnished to the State geologist of Tennessee by the State assayer. The Hiwassee opened last of 1852; the Cherokee and Tennessee early in 1852; the Caloway, Isabella, Eureka, and London, early in 1854.

Mines.	Amount produced since opened.	Production per annum.	Per cent. copper.	Gross value.
Hiwassee,	4,150 tons.	2,000 tons.	27	$162
Cherokee,	900 "	2,500 "	39½	237
Tennessee,	2,460 "	1,700 "	27½	165
Caloway,	500 "	1,950 "	31	186
Isabella,	9,500 "	3,279 "	24	144
Eureka,	370 "	3,141 "	25	150
London,	389 "	2,974 "	50	300
	18,569 "	17,735 "	av. 32	$192

The ore is raised from shafts, varying in depth 60 to 100 feet, by a single horse; it is then crushed almost entirely by hand, packed in boxes of 500 to 600 pounds, and transported on wagons sixty-five miles to Dalton, or to the junction of Ocoa and Hiwassee rivers, thirty miles hence on small boats to Loudon, the present terminus of the East Tennessee and Georgia railroad, and so on over the State road and your central road to Savannah, where it is exported principally to New York, while some finds its way to the smelters of Baltimore and Philadelphia.

When we consider that the mines are located in a mountainous country, and the consequent disadvantages of being so remote from railroad transportation, in procuring the necessary machinery and apparatus for working, and terms for transporting, the results are truly wonderful, challenging the world for a comparison in quality of ore and amount produced.

The extent and value of this mine as a source of national wealth are known and appreciated by few, if any; and who will pretend to calculate the vast revenue to our immense system of railroads in Georgia, when we think the present is only a beginning of what we may expect in one or two years more, when, in the place of fifteen or twenty shafts worked by a single horse, there will be fifty or a hundred worked by steam; and, in place of transporting thirty to sixty-five miles by oxen and mules, there will be constructed one or two railroads from points on the Western and Atlantic railroad, and East Tennessee and Georgia railroad. Nor are these rich copper beds confined to Ducktown, Tennessee; the belt continues in Georgia, where shafts have been sunk, and as good ore has been discovered as any in Ducktown. It is my purpose, in a future communication, to speak more particularly of the copper interests of Georgia.

GEORGIA COPPER MINES.

From Georgia we have the annexed statement relative to one of its mineral tracts:—

The mining prospects in this country are flattering, both as regards gold and copper. People are seriously and steadily at work to dislodge the rich minerals of this country, and their efforts are being crowned with success in some cases, and prospects of success flattering in others. I do not know of a single instance where the search making for copper or gold has yet been abandoned. It is true that the wildness of speculation and high prospective anticipations have somewhat mellowed down, and sober calculation and energetic effort have succeeded. Men are now at work instead of talking, and some of them have fully realized their former expectations.

R. H. Moore and Company have found, and are now operating upon, a rich vein of copper ore, and are preparing to send a quantity of it to market. This ore has been analysed, and contains upwards of thirty per cent. of copper, as I am informed. I suppose there is no doubt of it. In these veins, also, they have found a rich deposit of malachite, or carbonate of copper, of what extent is not yet determined. This substance is of a beautiful green color, and highly valuable for decorative purposes in building, and for other ornamental purposes. It is more valuable than copper. The prospect for an abundance of copper ore is as good in other shafts, now being sunk, as it was some months ago in Mr. Moore's. In the developments now being made, there is scarcely a useful or ornamental metal or substance but has been more or less found positively, or by indication, to exist. This country, by these experiments, is developing new facts in mineralogy. The indications of formation and outcrops are contradicting many of the doctrines laid down in the books of mineralogy and geology. And the theorist who has obtained his science from books will only be confounded by the actual demonstrations here made; in fact, a new book will have to be written to describe the mineral indications of this region; otherwise, scientific men will be at fault, and old

theories will not apply. A great want of capital exists here in order fully to develop our rich mineral resources. Scientific men, heretofore forming their opinions from books only, have not been favorable to the opinion of a rich copper region in this country, which, perhaps, has deterred capitalists from venturing the experiment. The same opinions apply equally to Ducktown, in Tennessee; but bold experimenters have proved the fallacy of these opinions, and have demonstrated each place to abound with copper sufficient to induce capitalists to take hold with fine prospects.

BOWDEN COPPER MINE COMPANY.

The property consists of 130 acres of land, located in the county of Louisa, State of Virginia, and two miles from Tolersville station on the Virginia Central Railroad, and fifty-seven miles from Richmond, Virginia, with a good road to the mines.

Professor N. S. Manross's private report was made to parties before the purchase, he having been employed by them for that purpose. The samples assayed by Professor Manross had laid out-doors and exposed to the weather for over four years, and, accordingly, were much reduced in per centage of copper. Subsequent developments by the present Company show a much larger per centage of copper.

FORESTVILLE, CONNECTICUT, *September 15th*, 1853.

MESSRS. CHITTENDEN AND SALISBURY—Sirs:—Agreeably to your request, I take this earliest opportunity to give you a brief summary of facts in regard to the mining property recently examined by me, under your direction.

The property is situated from two to three miles north-east of the railroad station at Tolersville, Louisa county, Virginia.

It consists of one principal tract, called the Groome Tract, containing 70 acres, of which a plot accompanies this report, together with effected or proposed additions, increasing it to 143 acres. The entire tract lies within the highly metalliferous belt of talcose rocks which traverses that portion of Virginia.

Gold might undoubtedly be found in some of the numerous quartz veins, or washed from the gullies upon the estate.

Two parallel veins of iron ore, one of them more than two rods in thickness, occur upon the estate, apparently traversing its entire length. The larger of these is at present worked at a depth of sixty feet. Much iron ore occurs also upon the surface, towards the northern part of the property.

The vein to which my attention was more particularly directed was one which had been worked for copper, under the name of Groome's Mine. Its course is north, 30—35 deg. east, with a dip to the eastward of about 70 deg.

It makes its appearance upon the northern part of the property, and has been explored at various points for a distance of 60 or 80 rods, continuing also upon the adjoining estate. There is little doubt that it might also be found farther south, and probably as far as the tract extends.

The thickness of the vein, as nearly as could be ascertained, is from four to six feet.

Indications warrant the opinion that the vein will increase in thickness with the depth, the rocks above being apparently less highly inclined than those below.

It may, therefore, be set down as inexhaustible. At the surface it contains only oxide of iron, resulting from the decomposition of the sulphuret.

Fifteen feet below the surface the vein is found in its natural, undecomposed state. It there consists mainly of iron pyrites, more or less mixed with copper pyrites, and also inclosing veins or nests of magnetic oxide of iron.

Three shafts have been sunk upon the vein; one on the north side of Contrary Creek, and two on the south. Of the latter, one (A) was sunk directly

in the vein, to the depth of thirty or forty feet; the other (B), on the back of the vein, some 75 feet distant. From the bottom of this, at sixty feet, a level was carried to the vein, and considerable ore taken out.

About 100 tons of ore from these two shafts is now lying upon the surface and in a building adjoining. It was raised entirely without blasting, and afterwards reduced to powder by the shovel alone. The ore is almost wholly free from gangue or rock of any kind. The cost of mining must therefore be very slight.

None of the ore has remained in its original state, but has been acted upon by air and moisture. In some portions, more than half the copper has been changed from the original sulphuret or copper pyrites into sulphate of copper or blue vitriol. Even that which was inclosed in barrels and placed under shelter, has undergone the same process. The decomposition has been confined chiefly to the copper, but very little sulphate of iron having been produced.

This fact shows an unusual tendency of this ore to decompose, and suggests that it might be advantageously employed for the manufacture of blue vitriol. The drainage of the mine, if worked horizontally above the level of the creek, would probably prove a valuable source of copper in solution, even after the working had ceased. The hills rise on each side of the creek to the height of 50 or 60 feet.

Samples were taken of the various piles of ore with especial care to secure a fair sample of each. These have been subjected to careful analysis, with the following results.

Nos. 1, 2, 3, 5, and 6, from the three piles in the building, from the one outside, and from one of the barrels, respectively, were mixed in about equal proportions. The analysis gave,

Copper in state of vitriol,	1·45 per cent.
" " pyrites,	3·94 "
Total per cent. of copper,	5·39 "

Sample No. 4 was taken from a pile lying by shaft (B), and came from the vein at 60 feet.

That pile had been more acted upon by the weather than either of the others. A few inches below the surface it was full of lumps and scales of blue vitriol; and much copper has no doubt been carried away by rains. The analysis gave,

Copper in form of vitriol,	3·87 per cent.
" " pyrites,	2·92 "
Total per cent. of copper,	6·79 "

From this it will be seen that more than half the copper in this pile has become oxidized by exposure, and that the vein carries nearly one and a half per cent. more copper at 50 than at 30 feet. The accompanying specimen of metallic copper was obtained from lumps of vitriol selected from this pile.

Finally, a mixture was prepared of the samples from this pile with the mixture of samples from all the others, and analyzed by the most accurate method known. It yielded copper 5·86 per cent.

From these analyses it appears, then, that the average of the ores now upon the surface cannot be above six per cent. metallic copper.

Of this, about one and a half per cent. is in a soluble state, and might easily be extracted upon the spot, by simply washing and precipitating with scrap iron.

The black substance, supposed to be oxide of copper, is magnetic oxide of iron in a disintegrated state, still showing, however, in some specimens the cleavage of that mineral when solid. Carefully selected specimens exhibit no trace of copper.

The following, then, are the principal facts in regard to the so-called Groome's Mine:—1st. That the supply of ore is very great, if not inexhaustible. 2d. That it can be mined at a very small expense. 3d. That it contains an average of five and a half to six per cent. metallic copper, increasing considerably in richness and width of the vein with the depth. 4th. Convenience of location as regards fuel and transport of ores.

With this summary, I close this brief statement of facts, begging that if any thing of importance has been omitted, you will inform me, that I may make up the deficiency. N. S. MANROSS.

The proprietors having become satisfied of the value of this property, and having duly organized the said company with such a capital as they believe they shall be able to pay large dividends upon when the property is fully developed, proceeded to set up steam-engines and other machinery, and erect buildings for the permanent working of the mines, and have already sunk a shaft, eight feet by twelve feet, to the depth of 113 feet, and struck the vein of copper, which is five feet in thickness, and which is very promising, with walls regular and well defined, and vein very uniform, consisting chiefly of yellow sulphuret of copper, a sample of which was analyzed by Professor Edward N. Kent, and contained fourteen and three-tenths per cent. of copper.

CHEMICAL LABORATORY, No. 116 JOHN STREET, NEW YORK, *August 14th*, 1854.

MESSRS. CHITTENDEN AND SALISBURY—Gentlemen:—The sample of copper ore assayed for you this day contains 14·3 per cent. copper. Yours, very respectfully, EDWARD N. KENT.

The Company have been fortunate in procuring the services of Thomas Martin, Esq., well known to the mining world as one of the most efficient, able, and experienced copper miners, having devoted thirty odd years of his life to copper mining in Europe and the United States. He has had charge of the mines from the first; and below will be found extracts from his letters to the Company. Under date of July 22d, 1854, he says:—

"Last evening, about nine o'clock, we came down upon the back of the vein, from which we have taken some good pieces of gray and yellow sulphuret of copper. I sincerely believe that all risk, as regards the properties of the mine, is passed, and that it cannot any longer be regarded as a speculation."

July 23d, 1854, he says:—"We have cut the lode, and have taken some fine specimens of gray and yellow sulphuret copper ore: we can now see about three feet of the vein. I believe that this mine will turn out well; I can have no doubt about it myself."

August 22d, 1854, he says:—"We have extended the south level about eighteen feet from the shaft, where we have a large lode from six to seven feet wide. The mine has a very promising appearance."

September 20th, 1854, he says:—"The lode looks very promising indeed; the 115-feet level is extended south 45 feet; ground much the same; lode about four and a half feet at this point."

Extract of a Letter from R. M. Bowden, Esq.

TOLERSVILLE, LOUISA COUNTY, VIRGINIA, *July 29th*, 1854.

Gentlemen:—I advise you we have a vein of five feet (and the whole of the vein not seen) of yellow and gray ore; and I have but little doubt, when fully exposed, it will be from six and a half to seven and a half feet in thickness, and each day's work shows the ore is becoming richer and richer. I hope you will not think, when I say it will prove to be the best mine of the day, that I am led away by present indications, and say so without grounds to support the assertion.

JOURNAL OF SILVER AND LEAD MINING OPERATIONS.

MINING IN WISCONSIN.

We are able to announce the appearance among us of the State Geologist, Doctor Percival, who seems to be actively engaged in the discharge of the duties of his office. He arrived here a few days ago, and at once commenced an examination of the lead mines in this immediate vicinity. This is the first particular examination that has been made, by any geologist, of the lead and zinc mines at this place, so far as we are informed. At this time there are no very considerable mines being worked here, yet sufficient operations in mining are going on to afford opportunities to examine and explore the mines to a very considerable extent, and we have no doubt but the examination will prove satisfactory to all.

We feel a still deeper solicitude in everything that pertains to the proper development of the lead mines here, from the fact that we fear inadequate fixtures are being worked or proposing to be worked, to drain and free the mines of water in other parts of the mining district. Of the abundance of lead contained in the mines in this place, we feel very confident—the great object to be attained, we think, is the procuring of sufficient engines and fixtures to remove the water to a considerable depth at once, or as fast as the pump shaft can be sunk, so that the ground may be rapidly drained and from one hundred to five hundred miners find profitable employment in working the leads. We think the main reason that has operated to make mining in localities drained by steam and horse power pumping unprofitable, is that the power used has been inadequate, consequently a much longer time has been occupied in taking off the water than would have been required with suitable fixtures. That breakages, changes of pumps, change of gearing—an unceasing round of expenses, disasters, and disappointments, all combined, the leads are slowly drained, the miners become discouraged, and little is or can be done, and the necessary consequence is loss of money and confidence, and a failure.

It does seem that the experience of all, without a single exception, who have pumped water, or are now pumping by steam engines in these mines, should be a sufficient warning to those who think of embarking in it, not to commence or expect to prosecute successfully the business, with a power less capacious than is sufficient to do the work of a two hundred horse, or even more power, engine. We are assured that the company being raised in this place will not start their work with any thing less, with which we anticipate the most satisfactory results.—*Platteville American.*

MISSISSIPPI MINING AND MANUFACTURING COMPANY.

A miner at Mineral Point, Wisconsin, thus describes the operations of this Company :—

The Mississippi Mining and Manufacturing Company of N. Y., have an office, blacksmith shop, and are building a boarding-house sufficient to accommodate fifty miners, and are putting up an engine of twenty-five horse power on the old Hedrick *lode*, two miles north of Mineral Point. This lode was discovered about eight years ago, and yielded upwards of two millions pounds of ore. The lode was in an east and west crevice on the top of a ridge formed of the upper beds of magnesian limestone. This ridge is about half a mile wide, and bounded on each side by a small spring branch which empties in the Pecatonica river. The sandstone which underlies the upper magnesian limestone crops out in the bottom of these valleys, and has a dip of about 10° from each water-course to the centre of the ridge. The lime-

stone in the centre of the ridge is about one hundred and seventy-five feet thick. The ore was taken from a large chimney or spread in the crevice, fifty feet wide, and one hundred feet long, and laid among loose rock, clay, and sands which formed the matrix of the vein. The main body of the lode was sixty feet deep, and the vein partially give out, and crevice closed going down, and was filled with iron pyrites and a ferruginous, ochery matter. The water level is seventy feet from the surface. East one hundred yards, and north fifty feet, from the Hedrick lode was worked another lode, fifteen years ago, which yielded some four or five million pounds of ore—this lode was in the head of a ravine, where an east and west crevice crossed; the ore laid in a chunk sheet form, among clay, sand, and loose rock; was fifty feet wide, and worked from the grass roots east, and in two hundred and fifty feet going west, dipped seventy feet, and has been followed in an opening under fifty feet of limestone. The vein got weak, going west, and was followed down to the water level. This company are sinking a shaft, six by twelve feet, on this dip of ore and centrally between the old lodes. The shaft is now seventy feet deep, and down to the water level the opening is not yet reached, but miners think that a few feet will take it through to good ore.

There are various opinions about the thickness of the sandstone which underlies the upper magnesian limestone in this district. In a deep valley, about one mile west from these diggings, the sandstone is exposed in bluffs two hundred feet high, and fills the bottom of the valley. Going north towards the Wisconsin river, this same bed of sandstone is exposed in places four hundred feet thick, &c. This company are erecting pumps to prove the portion of the upper magnesian limestone yet below the old diggings, and see if the sandstone presents sufficient mineral indications to justify the erection of machinery to sink through it and penetrate the lower lime rock.

LEAD MINING IN MISSOURI.

The early settlements in Missouri were made for mining and commercial purposes, and the locations made for these objects by the early French explorers, are still found to be the most suitable points at which to prosecute such enterprises.

When Philip Francis Renault and M. La Motte, about the year 1720, commenced their explorations for metals, they were soon rewarded with abundant treasure, especially lead, and the mines then opened are worked to this day.

When Pierre Laclede Leguest, on the 15th of February, 1764, desiring to engage in commercial pursuits, selected a position every way adapted, and laid the foundation of St. Louis. The propriety of the selection has been fully justified in its progress and present commercial greatness. So that, assuming those early explorers blessed somewhat with *prescience*, we are to regard Missouri as the State where commerce and manufactures are especially to be successful.

Almost every kind of mineral is known to exist in Missouri; but those of the most useful kinds in the richest abundance. Reference has already been made to the vast supplies of iron and copper, and in addition to these we have lead, coal, cobalt, nickel, magnesia, emery, zinc, also granite, marble, and porphyry, various useful earth, such as pipe, and pottery, and alum clays; also, kaoline and glass sand; some evidences of tin have been discovered, and some of the early French and Spanish miners reported some discoveries of silver, with some evidence of golden sands, indicated by recent discoveries. All these are now being looked to by order of the Legislature—a geological survey of the State is now progressing, and it is to be hoped it will eventuate in developing the vastness of our mineral wealth.

Lead was discovered in great abundance, in the southern part of the State, by the first explorers. Some of the mines were worked, and, in addition to supplying the home demand, much of the product was shipped to France.

The mines first worked are still productive, while many others, in various parts of the country, have been discovered, and have proved to be very rich. But lead mining, although the earliest commenced, has never yet been as systematically prosecuted as the great value of the mineral and the abundance of supply would seem to have justified. Very little is yet known of the extent of this formation; found at first upon the surface, it has only been developed where most accessible. As far as I know, there has been very little, if any, deep mining for lead heretofore in this State, the supply near the surface being found very abundant; and, doubtless, the application of capital and skill will show these mines to be greatly richer and vastly more productive than they have been heretofore. The early mines worked were Mine La Motte, Mine a Joe, Mine a Burton, and Old Mines. Many others began to be worked after the Americans took possession of the country; some have been abandoned, not because they were exhausted, but because more capital was required to operate them; but most, as before remarked, are still worked to good advantage, notwithstanding the want of the modern appliances for their development.

At the Cove mines, and the Virginia mines, in Franklin county, lodes of great power are said to exist; and although for want of suitable machinery the latter mine is not now in use, the former, or Cove mine, is worked to great advantage and profit, by Messrs. Skews and Valle, its proprietors.

In the Southwest the Messrs. Moseley, of Newton county, and the Messrs. Harklerode, of Jasper county, are successfully working lead mines, each having smelting furnaces in operation, and the metal is found very abundant. These are merely references to some of our lead mines; and as I have before remarked, the line of the Southwest road is almost entirely metallic—copper and lead being, from present indications, the most abundant; and beside this, the region of country extending nearly to the southern and eastern lines of the State is full of valuable minerals, although much of it has not yet been scientifically investigated. In this region lies Mine La Motte, the earliest worked and discovered mine in the State, and among the most remarkable mines in the world.

Here are found lead, copper, cobalt, and nickel—and it is said to be capable of producing these metals to the value of one million of dollars per annum, but is not worked to its capacity. The lead is separated at the mine, but the copper, nickel, and cobalt are shipped to the establishment of Messrs. Fleming & Co., in Camden, New Jersey, and there separated.

PRODUCTS OF MINES IN SPAIN DURING THE YEAR 1849.

From the Annales des Mines.

In 1849 there were in Spain 6465 mines, of which 785 were worked, and 5680 had been abandoned. From these 1785 mines were taken—

Lead,	618,228	quintals.
Malleable Iron,	841,424	"
Cast Iron,	813,704	"
Mercury,	18,474	"
Copper,	13,485	"
Zinc,	5,499	"
Salt,	3,775	"
Sulphur,	1,392	"
Litharge,	472	"
Regulus of Antimony,	150	"
Tin,	96	"
Gold,	46	marcs.
Silver,	99,403	"

COALS AND COLLIERIES.

ANTHRACITE COAL TRADE FOR 1854.

Shipment from Richmond to close of week ending September 19th,	1,020,881	tons.
Same time last year,	827,850	"
Increase,	193,031	"
Amount sent by Reading Railroad to September 20th,	1,568,400 17	"
" " Schuylkill Canal,	675,702 03	"
Total,	2,244,103 00	"
To same time last year,	1,800,940 10	"
Increase,	443,163 10	"
Lehigh coal shipment to September 16th,	824,768 12	"
Same time last year,	691,361 19	"
Increase,	133,407 13	"

CUMBERLAND COAL TRADE FOR 1854.

Total to September 16th, 1854,	444,350 06	"
September 10th last year,	310,123	"
Increase,	134 227 06	"

COAL SHIPMENTS FROM PITTSTON.

The coal tonnage from Pittston, for the season to the 1st August instant, was :—

Morganville mines—Samuel Holland, agent,	8,880	tons.
Irondale, " " "	9,120	"
James Freeland,	9,900	"
Bowkley & Beyea,	10,000	"
D. P. Fuller & Co.,	8,500	"
A. Price,	12,720	"
Total,	59,120	"

THE PRICE OF COAL.

The price of coal has of late been a subject of considerable speculation, and various opinions exist respecting the future. Old dealers tell us that in their experience when they buy early they seldom make a mistake in a series of years; and this has been the result of our own observations. Meantime we present some of the opinions of those at the fountain head of the trade who are well informed respecting the supply of the market.

The *Pottsville Journal* presents the following views :—

We are appealed to, from every quarter, to give *our* own views with regard to the supply of coal. Our candid opinion is that the price of anthracite coal cannot fall, unless all reliable calculations, as to the increase required this year, should prove to be unfounded—and unless the price of freights should fall. The freights between the coal regions and Philadelphia *will not be reduced* this year. The freight from Richmond to Boston, last year at this period, was $1.50—and in the early part of October, it run up to $2.80—in November to $3.10. Freight from Richmond to Boston is now $2, the lowest point it has reached this season—(in May last, it run up to $3.60 and $3.80 from Richmond)—it will advance again in October, as soon as the frost drives

away the yellow fever in the South, as many of the vessels engaged in the Southern trade are employed in the coal trade while the fever continues. Freights will, in all probability, go up at least $1 per ton to Boston, in the course of next month; which will more than double any reduction that can take place under any circumstances, in this region, even if the market were overstocked with coal. Only 2½ months of the season remain. The prices for coal are firm in this region, and the demand brisk. The coal goes off from Richmond as fast as it arrives, although orders were checked to some extent by the various publications made.

The increase in the supply of coal from the Schuylkill region since last December, is, in round numbers,	437,000 tons.
From the Lehigh,	127,000 "
Total,	564,000 "

It is admitted on all hands, that 300,000 tons of this supply properly belongs to meet the deficiencies of last year. Of the 300,000 tons sent down by the railroad from December 1, 1853, to April 1, 1854, it is well known that it was all consumed as fast as it arrived, and there was no coal in the markets in April last.

Deduct from the above	554,000 tons.
For this deficiency,	300,000 "
Leaving an increase of only	254,000 "
Deduct deficiency from the Lackawanna and Pennsylvania Coal Companies, short of last year's supply to the present time,	70,000 "
Leaving, *for the actual increase*, only	184,000 "

Add to this the probable increase from all the anthracite regions for the balance of the season—say 150,000 tons, and we have an actual increase of only about 334,000 tons this season, from all the anthracite regions. Should the season close early, the supply will be less, and if later than usual, of course it would be increased.

Of this increase the iron works, between this place and Philadelphia, and the Reading Railroad in their locomotives, will consume not less than *one hundred and fifty thousand tons*; and we are credibly informed that the iron works on the line of the Lehigh Canal will consume an increase of about 50,000 tons, leaving an actual increase of about 154,000 tons to supply the increase on the sea-board, in iron works, steamboats, steamships, stationary engines, household use, and all the various purposes for which anthracite coal is now used.

Above are the figures, examine them closely, and judge for yourselves, whether we or the coal operators have deceived the public with regard to a supply of coal and the prices this year.

The *Register*, located in the same region, thus treats the same question:—

The truth is, the present price for No. 1 red and white ash coal will be maintained. Coal of an inferior quality must decline, not because the whole product is not readily saleable, but because men of money and in good credit will not buy poor coal when they can get a prime article.

There is not sufficient capital among the dealers abroad, in consequence of the present state of the money market, to pay for the coal they require. Cash buyers of second or third quality coal will therefore obtain a material reduction in price from shrewd miners. Others will get full prices, and take poor paper for pay, and perhaps find before spring that their profits will be invested in protested bills receivable. It is not true that we have made large profits this year, as many abroad suppose. Some have done well, others made nothing.

The following article, by one conversant with the trade in Boston, explains the causes which have produced the advance this year:—

There is frequent inquiry as to the causes of the high prices of fuel. Those who have undertaken to answer through the press have usually passed unnoticed some obvious facts that bear upon the subject. One, whose business leads him to "keep posted," tells us that the miners of anthracite coal had so hard a time in 1850, '51, and '52, that many of them failed, and the others made little or no profit. The prices at which *they* sold coal in those years, and in the early part of '53, were so low that they had no inducement to extend their operations; the consequence was, that while consumption increased, the supply was about the same as before. The quantity mined in '53 was just about the same as in '52. Some places obtained a fair supply last year, while others were short. The receipts in Boston in '53 were 85,000 tons less than in '52. The consequence was, that here, and in many other places, the coal yards were as bare on the first of March as they usually are at the middle of April. And the coal dealers of the several cities were obliged to draw from this year's mining about 300,000 tons to supply last year's deficiency. Also, owing to the high price of iron, all the furnaces of Pennsylvania have been doing full work all the season, and have consumed about 200,000 tons extra; thus, 500,000 tons of this year's mining are taken out from the supply of the regular ordinary wants of the year.

Under such circumstances, the wharves at Philadelphia have been bare, from the beginning of the season up to the present hour, and the sellers there have had full control of the market. They have a chance to make (and they are using it) very large profit. Business men will not censure very harshly those who have worked four years with almost no profits, if they do use their present power, and accumulate rapidly this season.

The railroad and the canal, too, both have full work, and have advanced their rates. The cost of transportation from the mines to Philadelphia is from forty to fifty cents per ton more than has been usual this season. Coal, which in past years could be had for $3, or less, at place of shipment, will now bring $5.75 to $6. Few of the shippers have any to sell, even at these prices.

Freights, too, have ruled high, from $3.75 down to $2.50 per ton. This lowest rate is a dollar more than has been common in past summers. Why thus high? Partly because we have been obliged to bring on eighty to one hundred thousand tons this spring which should have come last autumn; but mainly because of *so much shipping*. Fashion requires large ships now, and in their construction vast quantities of Southern pine lumber are used, which is, and must be mostly brought out from Southern rivers in *small* vessels. Here is comparatively a new branch of trade for small vessels, while not enough of this class have been built, for the last three or four years, to keep pace with the loss which time and storms are constantly producing.

Circumstances are such that every coal miner can sell, at his own prices, all the coal that he can get either the railroad or the canal to take to market, and freights will not rule less so long as Southern pine lumber is in as much demand as at present. The railroad and the canal can keep every car and every boat at work on their own terms, from now to December next, without the possibility of forwarding enough to make up the 500,000 tons that have been used up for other than the legitimate wants of the year, and also the 300,000, which the usual increase of consumption will call for. The year wants 800,000 tons more than was furnished the last year; and yet, up to August 1st, under the pressure of a very brisk market, the gain over last year had only been about 280,000. It is not easy to see how the extra half-million over last year's autumn work can be sent over the existing lines of transportation.

Buyers should judge for themselves when it is best to obtain their winter's supply of fuel; but we can assure them that this information is from a source which entitles it to great weight.

PICTOU COAL.

The Treaty of Reciprocity, after being ratified by the Canadian Legislature, will then take effect. There is no question of this ratification. By one of its provisions, coal from the British colonies is to be admitted free of duty. We give the article itself entire, for the information of our readers:—

ARTICLE III. It is agreed that the articles enumerated in the schedule hereunto annexed, being the growth and produce of the aforesaid British colonies or of the United States, shall be admitted into each country respectively, free of duty:

Schedule.—Grain, flour, and breadstuffs of all kinds; animals of all kinds; fresh, smoked, and salted meats; cotton wool, seeds, and vegetables; undried fruits; dried fruits; fish of all kinds; products of fish, and of all other creatures living in the water; poultry, eggs; hides, furs, skins, or tails, undressed; stone or marble, in its crude or unwrought state; slate; butter, cheese, tallow; lard, horns, manures; ores of metals of all kinds; *coal;* pitch; tar; turpentine; ashes; timber, and lumber of all kinds, round, hewed, and sawed, unmanufactured, in whole or in part fire-wood; plants, shrubs and trees; pelts; wool; fish oil; rice, broom-corn, and bark; gypsum, ground or unground; hewn or wrought or unwrought burr or grindstones; dye stuffs; flax, hemp, and tow, unmanufactured; unmanufactured tobacco; rags.

This should only stimulate our miners to more vigorous exertions to maintain the foothold they have acquired in the Eastern markets, now that Pictou coal has equal chances against them, and possesses the advantage of greater proximity. If the duty on that coal has ever been of any advantage to Pennsylvania, its removal must be a disadvantage. And now that it is removed, the miners will do wisely to look at the free competition against which they have to contend.

A letter from Pictou, of the 7th of September, says:—

There are eighty-five sail of vessels in port, amounting to about 14,000 tons, all waiting their turn to load, and as the mines can furnish only about 250 chaldrons per day, it will be the 1st of December before many of the present fleet will be able to leave. Several vessels have left in ballast, and more will have to do so, or winter here. Barque Etiwan, Weeks, if unable to obtain her coal before her regular turn, which will be about the 16th of November, will leave on the 1st of October for Charleston, in ballast.

PARKER VEIN COAL COMPANY.

At a meeting of the stockholders of this Company, on August 31st, the counsel for the Directors made the following informal statement, premising:—

1. It will have to be decided what is to be done with the over-issue.

2. Whether the property of the Company is to be sold at ruinous prices, or the stockholders to raise the money to release the Company from embarrassment. He also states the liabilities of the Company, exclusive of capital stock, to be as follows:—

Mortgage and other liens on the Totten estate,	$123,492.80
Mortgage on the Jackson Mine,	35,415.32
Mortgage on the Westernport purchase,	60,000.00
Mortgage on the bottom land at Jackson,	600.00
Mortgage on the land on Savage River,	4,500.00
Mortgage on the Baneville estate,	33,000.00
Mortgage on the Stoney Ridge,	20,000.00
Mortgage on the Caledonia Mine,	95,000.00
Total,	$372,009.12

The floating debt of the Company appears to be about as follows:—

Noble, Hamett & Co., for their acceptance advanced to the Company, and all paid for,	$50,000
Captain Loper, balance due him on steamship, about	16,000
Insurance due on steamers to date of sale to Steamship Company, about	10,000
Freight due on canal to Baltimore and Ohio Railroad, above the value of coal at Baltimore, estimated at	6,000
Debts due banks at Cumberland and Hagerstown, secured by the guarantees of H. Mali and O. P. Jewett,	19,600
Claims of miners at Jackson Mine,	10,000
Total, about	$111,600

The property of the Company is as follows, to wit:—

The Totten estate, containing 301 acres of very valuable coal lands, situated on Georges' Creek.

The Jackson Mine, containing 237 acres equal quality, and in perfect order to be worked to the extent of 500 tons of coal per day.

The Baneville estate, containing about 2,800 acres of land, underlaid with the smaller veins of coal.

The Westernport property, containing 918¼ acres of land, a portion of which is underlaid with the big vein of coal, the balance only the smaller veins. The Company also own several other tracts of land situate in the Georges' Creek region, containing in the aggregate about 2,000 acres, portions of which are underlaid with coal, but are not considered of much value beyond the incumbrances upon them.

The Company also own $300,000 bonds of the Parker Vein Steamship Company, payable on the 1st of January, 1859, with interest, payable semi-annually, and secured by a mortgage on all the steamers to Shepard Knapp and J. G. Stacey, trustees; also 95,000 shares of the stock of the Caledonia Mining Company, the par value of which is $10 per share, being the proceeds of the sale of the Caledonia estate, containing about 352 acres of valuable coal mines.

ASSETS OF PARKER VEIN COAL COMPANY.

300 bonds Steamship Company, $1,000 each, estimated worth, at least,	$150,000
95,000 shares Caledonia stock, $10 each, estimated worth, at least,	142,000
Totten estate, worth, fair estimate,	250,000
Jackson Mine,	150,000
Balance of land, comprising Baneville, Stoney Ridge, Savage River, Westernport purchase, on which the mortgage debt is $118,100, which is included in the liabilities mentioned, estimated,	150,000
Total,	$842,500
Indebtedness,	489,009
Surplus,	$353,491

Mr. Hutchings also stated that under the previous direction there had been an over-issue of stock of 127,500 shares, as near as could be discovered—making the whole capital stock, as shown by the books, to be 157,500 shares, instead of 30,000 limited by the charter. He further stated that it is alleged that the parties participating in the fraud have loaned the Company from time to time over $500,000; but how far the Company has received and used the proceeds of the sale of the fraudulent issue, has not yet been ascertained, but that an examination is now being had to that object. When completed, the Directors hope to give a full and reliable statement of the Company's affairs.

The following resolutions were adopted by a vote of 70,027, with no negative on the first two, and 62,512 on the third:—

Resolved, That the stockholders of the Parker Vein Coal Company have full confidence in the present direction, and do hereby authorize them to make the best arrangement they can in regard to the over-issue or over-draft of stock through the account of O. P. Jewett. That the Directors are hereby authorized to provide for the extinguishment of the stock above the amount recog-

nized by the charter, either by selling its assets to retire the stock, or by application to the Legislature of Maryland for reduction of the par value of the shares, or in any way best calculated to attain that end.

Resolved, That the Directors are hereby authorized to use the assets of the Company to liquidate or arrange the floating debt of the Company.

Resolved, That the Directors or Trustees are recommended to open the transfer books of the Company.

THE CENTRAL COAL COMPANY OF LUZERNE COUNTY, PENNSYLVANIA.

This is the title of a company owning valuable lands, and located in Luzerne and Sullivan counties, Penn. We give the following description of their real estate, made by the President of the Company, Samuel F. Headley:—

The real estate of the Company has been selected with great care, and with particular reference to the Eastern or Atlantic, the Western New York, and Southern markets; the large tract known as the Henry Lebo Islands, is situate on the waters of the Black Creek, in the Lehigh coal-field, near the celebrated Hazleton mines. It contains over four hundred and fifty acres. Before the Company purchased these lands, in addition to an examination and survey of the same made by one of the most experienced practical geologists, Wm. F. Roberts, Esq., I gave the premises repeated and careful personal examinations, and satisfied myself of its great value; that the great Hazleton coal-vein underlaid the most if not the entire tract, and that it also contained other smaller veins of coal. Black Creek passes through this tract, cutting the coal formation so as to admit of free drainage to the mines; this alone adds vastly to the value of this property by saving expense of pumping, the danger, delay, and damages from being flooded. This tract contains excellent timber, quite sufficient for all the purposes of the mines for many years.

The tract in Pittston township, Luzerne county, is situate upon the pool at the head of the Pennsylvania Canal, in the Lackawanna river. It contains over 113 acres of land, being the undivided half of a tract said to cover 260 acres. When the North Branch Canal is completed, (which it is presumed will be the coming year,) this tract will be in direct water communication with the Northwest. The coal can then be sent either north or south by the Pennsylvania Canal. For particulars relative to this tract, see the report of the late James Stott, Esq. To those unacquainted with the character of Mr. Stott, it will be sufficient to say, that he was in the service of the Delaware and Hudson Coal Company, that he enjoyed their entire confidence, that he was also in the employ of the Beaver Meadow, Hazleton, and other coal companies, with great acceptance.

The tract in Blakely township, Luzerne county, contains about 300 acres of land, and is situate upon the line of the Lackawanna and Western Railroad. For particulars, see the reports of Wm. F. Roberts and the late James Stott, Esqs. They report the same as underlayed with 54 feet of the best anthracite coal. This property was purchased with reference to the Western New York and Albany markets, and is now, by the aforesaid railroad and the New York and Erie Railroad, in direct communication with Western New York; by the Chenango Canal with the city of Utica; and when the Albany and Susquehanna Railroad is completed, will then be with the city of Albany. In point of location, it is the nearest, and can, consequently, be sent to them cheaper than any other coal. In quality, the coal is admittedly superior, and I am assured by competent judges, that it will readily bring in market an advance of one dollar per ton over any other coal shipped by said railroad.

The tract in Sullivan county contains 650 acres of land, and was purchased with reference to the bituminous coal trade, in accordance with the original

design in procuring the charter. By a statement made in relation to these lands by Thomas S. Ridgway, Jr., Esq., Geologist and Mining Engineer, of Boston, they contain one workable bed or vein of coal about 5 feet thick, and there is a strong probability of their being underlayed by two others, and larger veins of coal. He estimates the quantity of coal contained in one vein, supposing that only 4½ feet thick, to be 7,000 tons per acre, or upwards of 4½ million tons in the tract. He says the coal in the Company's lands is nearly all above water level, and can be mined without difficulty as regards water or ventilation.

It is impossible to form any correct estimate of the true value of the Company's lands; the quantity of coal they contain is almost incredible, according to the measurements and estimates in the reports. The Black Creek property contains 12,168,000 tons; the Pittston property, 4,678,165 tons; the Providence property, 22,500,000 tons; total, 39,346,165 tons, of anthracite coal alone; which, at the low price of ten cents per ton, is 3,934,616 $\frac{50}{100}$ dollars, exclusive of the bituminous coal of Sullivan county; and supposing that the Company should mine and market 400,000 tons a year, they have anthracite coal alone in the three tracts to last them at that rate 70 years; and when it is recollected that the increased consumption of anthracite coal was in the past year over one million tons, and that the consumption and increased demand is far outstripping the increased supply; that while the ability of the mines now worked to supply the demand beyond a certain extent, and to which they are fast approaching, is limited, this rapidly and still accumulating increased consumption is *unlimited;* that under the present state of the coal trade, mines in Pennsylvania rent from 25 to 60 cents per ton; that many of the operators mine from one to two hundred thousand tons per annum; the great value of the property is placed beyond a doubt, and under proper management, the Company's property cannot fail to yield to the stockholders a rich return for their investment.

The coal from this Company will be sent by the New Jersey Central Railroad. The rates of toll and transportation is fixed at one and a half cents per mile. The road is 130 miles in length; cost, $1.95. The Company's land lies within 80 rods of this road, and the coal can be placed on the road by contract at 50 cents per ton. Entire cost at Elizabethport, New Jersey, $2.45.

The Company is in an excellent situation to commence active operations; its lands are all paid for, and it is free from debt of any kind.

COAL IN MISSOURI.

The extent of the mineral wealth of Missouri is yet comparatively little understood. A description of one of its sources of wealth, somewhat extended, is furnished by the following correspondence, for which we are indebted to the *St. Louis Republican:*—

We have also, for the purpose of developing and smelting these various metals, and also for turning them to every useful purpose, abundant deposits of coal, both in the State and contiguous to our borders. In the centre of the State, on both sides of the Missouri river, there is a most remarkable deposit of cannel coal—the extent of this deposit is as yet unknown—the strata is from thirty to seventy feet in thickness, and it underlies several counties. The mines in Cadoway county, near Fulton, I have heard, have become the property of a Philadelphia company, who intend building a railroad from the mines to the Missouri river, so as to make access to market easy; while on the south side of the river the Pacific Railroad passes for miles directly over this vast deposit, and within some one hundred and sixty miles of our city. The supply of this kind of fuel is absolutely inexhaustible, and it is so accessible, that by means of railroad and river, it can be laid down in our city at a very moderate price.

In addition to this great central deposit of cannel coal, we are furnished in the Southwest with another extensive coal field, which, on the completion of the Southwestern Railroad, must become exceedingly useful, and will greatly increase our productive industry. This coal has been discovered in Jasper county; it is known to extend westward into the Indian country, and doubtless underlays many of the contiguous counties. Its magnitude cannot be known until the country is scientifically examined and practically explored; but on the hills of Spring river, where only it is now worked, the coal crops out in heavy strata, and manifests itself in so many localities as to give ample assurance of most abundant supplies. A very short branch will unite the present discoveries with the main stem of the railroad, so as to make the mines available, and as this coal is of a very superior quality, being bituminous, yet free from sulphur, it will doubtless be used all along the Southwestern Road, not only for the purpose of running engines, but also in smelting and working the various metals with which that entire country is so abundantly supplied.

It may be objected, that all these fine deposits are too remote from our city to be made extensively useful to us, either as fuel for the production of motive power, for the supply of our great workshops, or for the smelting and working of minerals. I do not think so. Railroads not only annihilate space and bring into close proximity distant sections, but are also found most efficient agents in promoting a cheap as well as speedy transportation, especially of such commodities as this; and as our railroads are owned by our own citizens, it will be their interest to reduce the charge on fuel to the least paying fraction, and thus, by increasing the consumption, greatly extend transportation.

But if this supply should on experiment be found too expensive, we have other resources, and so ample and accessible is the supply, that we need have no fears, nor indeed need we look to the other sources only as incidental.

Our neighboring State of Illinois has, along her western border, especially along the American bottom, an inexhaustible supply of excellent coal, which will supply all our wants for generations to come. This coal field certainly extends from the bluffs, some six miles from St. Louis, eastward, at least to the Kaskaskia river. It has been proved in various places, both along the bluffs and through the interior, and has everywhere been found not only excellent in quality but apparently inexhaustible in quantity.

For many years St. Louis has been principally supplied with coal from the Illinois mines at the bluffs; but from recent investigations it has been ascertained, that the mines longest worked are neither the best or most abundant that are to be found along the slope, and it is also ascertained that at and near Belleville, and beyond that city, the same beds of coal extend.

Thus there is close in our vicinage, (excluding entirely the coal mines say four to six miles west and south of St. Louis, on the Missouri side,) a great abundance of coal, which can be furnished to our manufacturers at a very fair rate, as soon as the railroads, now nearly finished to these mines, shall be put in operation.

The Belleville and Illinoistown Road, now finished nearly to the bluff, is required, by its charter, as I understand, to transport coal from Belleville to the river, opposite this city, fourteen miles, at not exceeding one cent per bushel. The mines at the bluff are about half way, and along the bluff, on either side, are valuable mines, to which lateral roads will doubtless be built, and thus cheap transportation be had for this valuable product. North of the above, the Ohio and Mississippi and the Atlantic and Mississippi railroads penetrate the bluffs, and furnish transportation from the rich mines in that region, and also for the mines east of the bluffs; and thus railroads, in competition, bring to our very doors, at the lowest possible rates, this most useful article.

All these bluff mines can be cheaply and easily worked—the most elevated layer of coal is found some forty or fifty feet above the level of the lands in

the American bottom—there is, therefore, no difficulty experienced from accumulated water, as it has free and ample outlet to the front of the mine.

Some time since I made a visit to one of these mines, a description of which will give a general idea of the whole, so far at least as the extent of the deposit is concerned, and all of these mines may be as advantageously worked as the one I visited, if the same care and method is employed.

Messrs. Belcher & Brother, requiring an immense amount of coal for the use of their extensive refinery and its appurtenances, and being subjected occasionally to disappointments in obtaining ample supplies as needed, purchased a mine at the bluff which had been worked for some time, and now obtain ample supplies, and at considerably less cost than heretofore.

The miners furnish everything themselves, and are paid a certain price per bushel for the products of their labor. When the coal is taken from the various rooms they work, for drifting, opening passages, &c., &c., they are paid by the yard. The coal, when mined, is hauled to the platforms outside with mules, at a certain rate per bushel, where accounts are kept of each man's product, by a clerk devoted to that service.

All the work in the mines is done as directed by a foreman, himself a practical miner, and watchful of the interests of all concerned; he also sees that the proper course is kept in drifting, and ample supports are left at proper distances, and that every precaution is taken to insure safety and health. Every Monday a clerk goes over to pay off the operatives; each man has his number, the account of his operations for the week is presented in his presence by the clerk of the mines, and before the superintendent—if he has had oil or powder, or if his house-rent is due, these are regularly deducted, and he is paid, in cash, the balance, giving a receipt in due form in a book to Messrs. Belcher & Brother for the amount. As in all the operations of these gentlemen, everything is particularly systematized, and all seemed perfectly satisfied with their proceeds.

I saw on pay day, when there, all the men and boys gathered from these mines, each with his leather cap and extinguished lamp—men from almost all nations, especially Germans, French and Irish—all working in harmony, and each one perfectly satisfied with his payment. So much for judicious systematic arrangements.

The railways through the main avenues, on which the cars where located are drawn out by mules, extend on to a large platform, alongside of which the large wagons are placed, in which the coal is placed for transportation to the city.

From the mines to the Belleville turnpike road, this passes through a large inclosure, embracing the extensive stables belonging to the firm, where are housed and taken care of the horses and mules, amounting to nearly one hundred, and employed in the transportation. Here is also a good dwelling house, where the teamsters have boarding and lodging. Sixteen large wagons leave the mines every day, and all return in the evening under the general superintendence of a "master of transportation," with all the quietness and precision of a military movement. The mines have now been worked a long time, yet they show no signs of being exhausted, and, indeed, when reaching the line of the Company's land in any direction, *the vein* continues on, unimpaired. In the last eight months there has been taken from this mine over 400,000 bushels of excellent coal. They have progressed into the bank 670 feet, and are operating on both sides of the main avenues. The rooms are large, extensive columns are left to sustain the roof, and these insure safety to the operatives, while the vein itself is from six to seven feet thick of clean beautiful coal, and the roof is composed of a solid limestone rock, of the hardest kind.

This strata of coal extends, as I have said, along the bluff for miles, and eastward into the country to an unknown extent, certainly beyond Belleville, where it is now advantageously worked; while there are indications of its

continuance at least to the Kaskaskia river, for it has also been partially opened there, and is found to be excellent.

Now, if an acre of this coal land will produce, as is estimated, 200,000 bushels of coal, when will the region I have been speaking of be exhausted? Never. There is coal enough for all our purposes, no matter how much the demand may increase. Besides, there are doubtless other veins below the one now worked, possibly much better than even this present strata. No investigations have been made, except in a few cases where another vein of very superior coal, from three to four feet thick, have been found, some few feet below the upper strata.

Others are, doubtless, still below, and time only will probably develop them. The immense supplies easily accessible, when cheap transportation can be had to the city, will induce the more extensive working of these mines, while the certain, the extensive demands from our numerous steamboats, the hundreds of engines propelling machinery, and the smelting and working of these abundant supplies of metals in our city, as also the supply of private and public houses, will always make the operations remunerative.

GAS COAL.

Considerable demand has recently arisen for the gas coal of Preston, Va., and consequently, quite a large amount of land in that region has changed hands. These lands lie adjacent to the Baltimore and Ohio Railroad, in the vicinity of the Little Tunnel, about four miles from the Kingwood Tunnel. They are said to contain coal superior for gas purposes to any other in the United States.—*Cumberland Journal.*

PIEDMONT COAL.

The largest portion of the Cumberland coal field is situate in Virginia, and not in Maryland. The only incorporated coal company in operation in this part of the State, is the New Creek Coal and Iron Company, who have expended a large amount of money in opening their coal, and erecting excellent houses for the accommodation of their miners. Their facilities for doing a large business are only limited by the capacity of transportation to the Eastern markets. In quality it is not surpassed as a generator of steam, being easy of ignition and a rapid generator. The powerful "camel" engines that run above this point, up the heavy grades, have consumed several thousand tons this season, and the engineers assure me that the fire-boxes and grate-bars of their locomotives are seldom injured by it. Piedmont is a thriving town. It is the central point between Wheeling and Baltimore. The Railroad Company employ about 300 mechanics in their beautiful and extensive machine shop.—*Ibid.*

VISIT TO THE DORA COAL FIELDS.

One day last week, in company with Professor S. of the University, and some other gentlemen, we paid a visit to the coal fields.

We arrived at Mount Solon about nine o'clock, where we were joined by Mr. C. and Dr. H., who went with us to the coal fields, which are in the North River Gap, about six miles north-west from the village. We had not been there long before Mr. S., the agent of the Dora Company, made one of our number, and gave us much information about the coal and iron deposited in that region, and the intentions of the Dora Company. The vein which has been opened is some eight feet thick, and furnishes anthracite coal of the finest quality. We saw several tons of it, which had been mined, and it seemed in every respect equal to the best Pennsylvania coal.

We examined another vein up the side of the mountain, some two or three hundred feet, which seems to be much thicker than the one which has been opened, and we are told that there were two others, which we did not take

the trouble to look at. Mr. S. informed us that he had explored the mountains for miles around, and that he had seen the outcroppings of coal in a considerable number of places, and he is of opinion that the supply is inexhaustible. Dr. Rodgers thinks that these coal fields will never prove valuable, on account of the veins being distorted or disturbed. He never examined them very carefully, and may be greatly mistaken. He is a man of science, and a celebrated geologist, but still he may miss the mark as widely as other people. It is very well known that he has come to wrong conclusions as to deposits of coal and ore in other places, and we hope and believe the result will prove that he is greatly mistaken as to the Dora coal fields. Dr. Rodgers' report had induced us to believe that Dora was a humbug, and during the last session of the Legislature we did not feel as much interested in the measures proposed by the friends of the Company as we would have done, had we not been prejudiced against the concern by the report referred to.

Our visit has very much strengthened our faith in the Dora Company, and we hope their most sanguine expectations will be more than realized. Mr. S., the agent, informs us that a large furnace for making iron, with all the necessary buildings for a large number of workmen, are to be put up at once, and that it is expected that the furnace will be in operation early next year. It is to be located near the Yellow Springs, about two miles above the opening in the coal vein which we visited. Very near the Springs are said to be inexhaustible supplies of the best iron ore. Carbonate of iron, which may be made into blooms at a very small comparative cost, is found near the place in large quantities.

We know of no region in all this part of the State which appears to be so rich in minerals as this, and we hope that in the hands of the Dora Company it may be fully developed, and prove, as it will, of vast benefit to all this Valley.

If the Company is not disappointed in its expectations, and meets with the success which now seems to await it, a railroad to Harrisonburg will certainly be made in a very few years. The route for a road is one of the very best anywhere to be found. From the Springs, near which the furnace is to be erected, to Harrisonburg, no obstacle worth considering lies in the way. The valley of the North River is smooth and level, so much so that for miles the grading of a railroad would cost but a few hundred dollars.—*Rock Register.*

PEAT FOR FUEL.

The *Waterbury* (Connecticut) *American* says that two beds of peat have recently been discovered about two miles from that city, and that two joint stock companies have been formed, with abundant capital, for the purpose of supplying it as a fuel for market.

COAL ON THE NORTH PACIFIC AMERICAN COAST.

The existence of coal on the Pacific American Coast was accidentally discovered near Bellingham Bay, Puget Sound, by the falling of a tree, around the roots of which particles of coal were found adhering. Further search disclosed a vein of real bona fide coal, which was tried and found to be good. This fortunate discovery induced different parties to prospect or look after other veins, and resulted in the disclosure of the present extensive coal region around Bellingham Bay. A gentleman, lately from that locality, mentions the fact that two brothers, in the course of their search, found some small pieces of coal on the beach, and, subsequently, struck the vein close by, which turned out to be of immense thickness and highly valuable. They sold their right to the entire vein for the sum of $20,000. After the establishment of the existence of coal, efforts were made to work the mines, but the scarcity of miners, and high rates of wages, freights, etc., made it unprofitable. There

is no doubt that the coal fields of the northern coast, including Vancouvers Island, are of immense extent, and capable of supplying all the wants of this coast north of Panama. The present depressed condition of the coal market almost excludes the domestic coal from being used, as the price will not warrant the mining and transportation without involving a heavy loss. From the continual increase in the number of steam vessels, and the prospect of the employment of many more, coal is, and will continue to be, a heavy item for which we pay in cash. The probability is, that, before a great while, the price of coal will advance on account of the high rates of freight from England and the Atlantic border, in which case a sufficient price may be had to warrant a more extensive working of our domestic coal fields.

There is no good reason why the money which is now paid for coals should not be retained at home. We have the coal fields to supply the consumption, even as we had the arable land to supply us with grain; all that was required then was, to raise the grain and drive foreign produce from the market. This has been done in barley, oats, and wheat, and the immense sums formerly paid for grain and flour are now obtained among us. The country is that much richer. Now the same cause will produce a like effect. We have the coal, but it must be produced in sufficient quantities to supply the demand, and drive the foreign article from the market by making it unprofitable to import it. The deeper the domestic veins are penetrated, the better the quality of the article, which may eventually prove equal to English soft coal, or the best Lackawanna. The comparative scarcity of firewood at available points increases the consumption of coal; but for steam purposes the presence of coal is of vast importance, and will no doubt prove of incalculable benefit to the Pacific American coast, in river and ocean steam navigation as well as in manufacturing. Let the domestic coal fields be opened and worked more extensively, and thus keep at home the large sums annually expended for this essential article.—*Alta Californian.*

HAMPSHIRE COAL AND IRON COMPANY.

We observe that the works of the Hampshire Coal and Iron Company, near Piedmont, are rapidly drawing to completion. The track on the tram-road, which is one half mile in length, is now being laid, and they will have the rails all laid on the two planes in about ten days. Labor has been very high and very scarce in the neighborhood of this work since its commencement in May last; but the contractors, Messrs. Dudly and Ball, being men of industry, have pressed through every difficulty with commendable zeal and perseverance.

The iron rails of the T pattern, now being laid down on three tracks of tram-roads and incline planes, were manufactured at the Mount Savage Iron Works, and exhibit a most excellent quality of metal, and the finest workmanship—giving further evidences of the fact, that we have within our mountains and valleys all necessary material and appliances with which to carry on and complete such public improvements.

This Company will probably be engaged in sending coal to market in a few weeks. They have already effected sales of a large amount to dealers in the Eastern markets.—*Cumberland Journal.*

THE FRANKLIN COAL COMPANY.

The incline plane of this Company is under full headway, and Messrs. McCulloh and Kelly, the contractors for doing the work, now have a force of some forty men engaged, with daily accessions.

The opening recently made in the Big Vein of coal on this Company's property exhibits a solid and uninterrupted breast of fourteen feet of coal, of as pure and beautiful a quality as any in the George's Creek region.

This Company is made up of good and substantial material, the members

being composed of citizens of Allegany County, Alexandria, and Baltimore — men of capital, enterprise, and sterling business habits, who have made every judicious arrangement, looking to an extensive trade in coal, coke, etc. Their investments were not made with the view of mere speculation, but intended as the ground-work of bona fide operations on their own account.

The improvements now in course of construction will be completed by the first of the new year, and in anticipation of the event the Company have already large orders to supply.—*Ib.*

IRON AND ZINC.

MANUFACTURE OF SLAGS.

The American patentee of the invention for the manufacture of the slags of blast furnaces, has purchased an English patent in London for a similar process, and has made many improvements which add greatly to the beauty and perfection of the manufactured articles. The following, from England, describes the recent proceedings of Mr. Smith :—

The enormous quantities of scoria cast aside daily from the blast furnaces of the iron-works of the South Wales coal field are, it appears, about to be turned to good account by the ingenuity of Dr. Smith, of Philadelphia. This gentleman, with a staff of assistant chemists, has for some time been staying at Merthyr with a view of experimenting upon the blast furnace scoria, with the object of producing therefrom a variety of articles in daily use, such as square tiles, paving flags, bottles, and utensils of domestic use. In converting the furnace cinder, Dr. Smith has been very successful. The bottles thus made are much tougher and the annealment is more perfect than in the common glass ones, from which, in their appearance, the new bottles cannot be distinguished.

MARQUETTE IRON REGION.

This interesting region has recently been visited by parties from Detroit, from whom we have the annexed sketch :

I have spoken of this as *the iron region*, and so it is emphatically. No sooner do you set your foot upon the shore, than you discover evidences of it. The common rocks of the country are so impregnated with iron, (by sublimation probably,) that the natural color of many of them is entirely changed. There is a mass of greenstone rock (a species of trap) close to the landing, which is thus colored a dull red through its entire structure, its natural color being a light green. And a few miles in the interior I noticed a mass of quartz rock, of the same dull red, or iron color, its natural color being white, or nearly so. Indeed, I have noticed no kind of rock here which is not sometimes to be found thus impregnated and colored, insomuch that it is often difficult to discriminate, without a close examination, between the different kinds. In many places the soil is also colored the same hue.

The nearest mine that has been opened, is that of the Eureka Iron Company, located just two miles from the landing. The surface indications were not, geologically, the most favorable, it being apparently a mass of chloritic slate, in a nearly vertical position, interlaminated with iron, the ore being good, but the layers rather thin. Every blow which has been struck, however, has inspired increasing confidence that there is ore in abundance there, and of the best quality. The slate runs out, and the iron takes its place, as the miner advances in his work, and already the former has nearly disappeared.

I observe that many have a sort of geological notion, that iron ores to be worth mining, must occur in connection with the trap rock, but such persons show a very superficial knowledge of geology. Some of the best ore beds in England have no connection with trap, as I can testify; and in several other countries there is the same want of connection. Foster & Whitney, the U. S. geologists employed here, say in their celebrated report, "It is a mistake to suppose that there is any necessary association between the iron masses and the trappean or any other rocks." And then, after citing several instances in our own and other countries, in which the connection does not exist, they go on to say, that "in the Lake Superior region, the trappean rocks very often, but by no means invariably, occur in close proximity to the great deposits of ore." See their report, vol. ii., page 67. In another place they speak of large and valuable deposits of ore occurring in connection with the slates in this region.

This bed has the essential advantage of being in near proximity to the harbor. The ore, too, is much more easily detached and broken up, than are the ores of the iron mountains. It is true that it can be blown off in greater masses at the mountains, but the breaking up is a more tedious process, as is also the drilling. The cost of mining, however, will be but trifling in either case, probably about fifty cents a ton. The per centage of iron in the Eureka Company's ore is large, though something less than in that of the iron mountain ore, but it is sufficiently rich to manufacture to advantage, and it has been pronounced by Professor Silliman, upon analysis, to be superior to any iron ore of which he has any knowledge.

I had quite a curiosity to see the Iron Mountains, and off I set on horseback in quest of them. The distance to the nearest (the Jackson or Sharon Company's) is fifteen miles, the way the plank road is laid, and to the Cleveland Company's it is seventeen or eighteen miles. The Cleveland Company has two of them, the largest of which rises to the height of two hundred feet from its base, and forms the culminating point between Lakes Superior and Michigan, being more than a thousand feet above the former. This immense mass is nearly worthless for manufacturing purposes, on account of its being laminated with jasper; but its walls, thus laminated, present a spectacle of great beauty. The entire mountain seems to be made up of alternate layers, or bands, of jasper and peroxide of iron, varying in thickness from the sixteenth to the half of an inch. The deep red of the jasper contrasts magically with the steel gray of the peroxide, and then, to heighten the effect, the layers thus alternating present every possible variety of outline, sometimes waving in gentle undulations, and sometimes twisted and contorted into strange convolutions. The wall of the mountain, thus fantastically ribboned with stripes of harmonizing and brilliant colors, presents a scene of most fascinating beauty. It admits of a high polish, and may be used for ornamental purposes; but the very element which makes it so beautiful, renders of little worth what would otherwise be of inestimable value as an ore, though some say it can be wrought into pig metal.

A portion of the mountain of the Cleveland Company is also banded with jasper, but there is probably enough which is free from it to furnish all the ore they will ever want. The Burts have a choice location half a mile further on, but I did not go to it.

The Jackson Company's mountain is about seventy-five feet high, 1000 feet wide, and is quite elongated. Some of it is jasper, but large portions of it are not. It is an immense mass of iron; some thousands of tons have been quarried out upon one side, but it is not all equally good. Deep excavations are made in places, to get the better quality of ore, leaving portions of the solid mass projecting, which are of less purity. I notice that considerable jaspery ore is quarried with the rest, and thrown aside. Foster & Whitney analyzed two specimens of the ore of this mountain, one of which, as stated in their report, contained 68, and the other 69 per cent. of metallic iron. It

rted that choice specimens of it have been found which contain as high per cent. It is so hard that it has to be roasted, that is, burned and like lime, before it can be forged.

These ores are pre-eminent, not only for their great abundance and for the high percentage of iron they contain, but for their freedom from the injurious elements which enter into the composition of most other iron ores, and which greatly depreciate the quality of the iron they make. These injurious elements are chiefly sulphur and phosphorus. Sulphur gives a porous texture to iron castings, while phosphorous, though it gives fluidity to the melted metal, makes it brittle when cold. There are no ores in the country except these which are free from these noxious ingredients, and it is impossible fully to separate them. The reason why stone coal does not make so good iron as charcoal, is that it contains so much sulphur, which vitiates the iron.

This seems to be the cause of the superiority of Lake Superior iron over all other iron in the world. The following scale shows the strength of this iron as compared with that of other countries.

The Swedish bar iron will sustain in weight,						58,180 lbs.
Best English iron,	"	"	"	"		68,544 lbs.
Russia bar iron,	"	"	"	"	"	76,069 lbs.
Carp River iron,	"	"	"	"	"	89,160 lbs.

THE CLARENDON IRON WORKS.

Yesterday afternoon, by invitation of Mr. H. M. Drane, agent of the new machine shop and foundry, now being erected in the southern portion of the town, we visited the location of the works in progress, which seems to be a good one, affording excellent facilities for business, either in or out of town. The space upon which the buildings are to be situated is 264 feet by 210 feet, having a passage twenty feet in width, leading down to the Company's wharf, which has a front of 100 feet on the Cape Fear River. The building for the "finishing," or machine shop proper, has already advanced to some height, and is being pushed forward with energy. It will be a handsome and substantial brick building, of 100 feet long by 50 feet wide, and 40 feet high. The buildings for the foundry, boiler shops, blacksmiths' shop, etc., will be on a similar scale, both as regards size and adaptation to the purposes for which they are designed, and arranged with reference to an easy means of communication between themselves, and an economical handling of work. They will be shortly commenced, and rapidly pushed forward to completion.

"The Clarendon Iron Works" is the name selected for this establishment, and the Company by which it is being put up is composed of a number of gentlemen of capital and energy residing here. We believe the object is to organize definitely under the general act of the Legislature, passed to encourage the investment of capital in mining, manufacturing, and so forth.

The capital of the Company is ample, and the buildings are those of a first-class establishment, into which hands and machinery will be put to meet all orders promptly and satisfactorily. It is proposed to build stationary engines of all sizes, condensing and non-condensing; circular, upright, and portable steam saw-mills complete; flour and grist mills; mining machinery; water-wheels; boilers, of all kinds and sizes; iron railing; bridge castings, and iron and brass castings of all kinds; steamboat engines; pumps; heavy and light forgings, etc., etc.; and, in time, to build locomotives, should the demand warrant. Of course, repairing of all sorts will be done. The Company hopes to get into operation by the middle of November.—*Daily Journal.*

DUTIES ON RAILROAD IRON.

This is a subject of importance to the iron interest, and cannot be too

thoroughly investigated. As a proof of its consideration, we insert the annexed article, addressed by Professor W. W. Mather to the *Railroad Record*:—

SIR:—Your views of the remission of the duties on railroad iron, and the effects of the tariff on our railroad system and on the completion of our roads, are doubtless correct. The question with statesmen who make laws to regulate commercial exchanges is, or should be, *What, under all the circumstances, will be for the best interests of the country?*

As regards railroad bars, large quantities are and will be required for many years, not only for building new roads and completing those in progress, but keeping them all in repair. The remission of duties would be of present advantage to the railroad interests, but it is believed that it would result in breaking down and closing all the railroad mills in our country, and prevent that rapid development of the iron business, and of the great extension of the manufacture of railroad iron now in its incipient stage in the United States, and which is so important that it should be *fostered* even at a heavy temporary sacrifice. The writer feels a deep and abiding interest both in the completion of the roads in progress, in the railroad-mill establishments, and in the extension of the manufacture of railroad iron. The resources in materials for this manufacture are exhaustless in many favored localities. Iron masters are now convinced that iron can be made easily and cheaply from stone-coal, and from iron ore that they have been accustomed to reject from their charcoal furnaces. Several coal furnaces are in operation in Ohio, and many of them in Pennsylvania, and many more are building, intended to work with stone-coal. This mode of manufacture is the only one that can compete with the Welsh and Scottish iron, and it is only recently that it can be said to have overcome the prejudices of those engaged in the iron manufacture. The large profits realized on pig-iron, the demand for which fully equals the production in Ohio, the relatively smaller profits on railroad bars, and the lack of sufficient capital seeking investment in the iron business, have prevented a rapid extension of the railroad iron manufacture in Ohio, where greater facilities for cheap manufacture exist than in any other part of the United States, or probably in the world.

Notwithstanding these causes, capital is already invested to the extent of $10,000,000 in railroad mills and furnaces for making railroad bars, in six of the States, viz.: Pennsylvania, Ohio, Massachusetts, Virginia, Maryland, and New Jersey. The estimated production of these works for 1854, in the *Philadelphia Bulletin* and in the *Railroad Record*, is 160,000 tons; but in that estimate only one mill in Ohio was named, viz.: that of Portsmouth—5,000 tons, while there are railroad mills at Hanging Rock and Ironton, and probably at other points in Ohio. These iron works give employment to 18,500 men, and directly support a population (their families) of 92,500, which consume provisions at $50 per head per annum—$4,725,000. The wages of 18,500 men, at $300 per annum, are $5,550,000.

The produce of this labor, 160,000 tons of iron railroad bars, at $60 per ton, is $9,600,000. This is all derived from the labor, skill, and capital applied to begin the development of our dormant mineral resources; and it is all distributed in the community, instead of being sent out of the country, to pay for foreign labor and production. The production of railroad iron in the United States has been and still is small, compared with the consumption; but we have all the facilities for the manufacture and transportation of railroad iron. Iron ore capable of producing 5,000 to 10,000 tons of iron to the acre, and coal and limestone to make it, occupies broad areas in the iron belt, which is traversed by the Ohio river, its tributaries, and by several railroads, opening communications and facilities for transportation in every direction.

Capital only is now wanted, and a feeling of confidence in our law-makers that they will pursue such a course of policy that capital invested shall not be

destroyed by their vascillating measures, to give such a development to the iron business as has not been thought of, except by the few. We can and ought to be free from the importations of foreign iron, and in a few years we will be, if Congress continues to protect the iron manufacturer.

The extension of iron manufacture thus far, has been almost entirely from the surplus profits of iron masters in Ohio and Kentucky, and perhaps mostly so in Pennsylvania.

Welsh iron masters need only to appreciate fully the advantages for making iron with stone coal, in southern Ohio, to transfer some of their manufacturing establishments for rail-bars to that district, already swarming with a Welsh population which has settled in a coal and iron region, like their native hills.

Although it would be a benefit to the railroad corporations temporarily, to abolish the duties on railroad bars, it is deemed a short-sighted and temporizing policy, that would, by so doing, prostrate all the enterprise already engaged in the manufacture of railroad iron in the United States; and, still worse, repress for many years the development of that branch of the iron business in Ohio and Pennsylvania, Kentucky and Virginia, where the facilities for cheap production, and for transportation in every direction, are unrivalled. How long shall we bring railroad bars 4,000 miles, to lay down across the iron ore beds, and coal beds, where every facility exists to make them as cheaply as in Wales?

CASTINGS IN MALLEABLE IRON.

Mr. R. A. Brooman, the patent agent for a correspondent, has specified an improved method of preparing wrought-iron, so that it may be capable of being poured or cast into moulds for the production of malleable castings or articles, which shall have all the strength and qualities due to the wrought iron. The invention is designed chiefly for the manufacture of railway wheels; but is equally applicable to the production of other articles. The process is as follows:—The metal employed may be either scrap wrought-iron, or bars or plates cut into small pieces, and the melting is to be performed in crucibles, such as are used for melting blistered steel. The operator weighs out the iron in quantity proper for a charge in the crucible according to its size; he then mixes with the iron about one per cent. of charcoal by weight, or of any other suitable carbonaceous matter which will afford that proportion of carbon; and finally adds one per cent. of manganese, and one per cent. of sal-ammoniac. These materials are to be placed in the crucible, which is then to be covered, as the melting must be performed out of contact with the atmosphere. The crucible is then introduced into a proper furnace, where a fire is raised, and a heat obtained sufficient to reduce the iron to a melted mass, which temperature is about 15,000° Fahr. This degree of heat must be maintained for about three hours, when the material will be in a state fit for pouring into the moulds. Railway carriage wheels, formed of this material, can be cast with a chill, as in the case of common iron castings; and they will moreover be malleable, so as to be capable of being treated under the hammer in the forge, and formed into other shapes. In the making of other articles, not requiring to be chilled, they may be subjected in like manner to alterations in shape, or otherwise be treated as malleable wrought-iron is usually worked. Articles may also be manufactured having part of their shape made in the moulds, and their form completed by forging. Thus, intricate shapes and ornamental work may be accomplished with great facility and in a superior manner; thus forming articles highly ornamental, as well as those for mere utility. The patentee claims the method of treating malleable iron so that it may be capable of being used in the production of malleable castings, as heretofore described.

GERMAN IMPROVEMENTS.

We have in hand numerous articles relative to improvements in furnaces and in iron manufacture in Germany, the translation of which could not well be presented in a suitable form in this number of the Magazine.

MISCELLANIES.

MINERAL RESOURCES OF THE COAST MOUNTAINS.

The minerals of these mountains are widely dispersed throughout their entire extent; they consist principally of copper, iron, lead, silver, gold, nickel, and antimony, with agates, calcedony, and many others too numerous to mention here, but which will be found under their proper head.

The metallic minerals are widely distributed; the ores of copper are found in the form of carbonate, sulphuret, and silicate, among the Santa Cruz Mountains; in the vicinity of Rincon Point, south of San Francisco, it is found sparingly disseminated among the trap and metamorphosed rocks of that section. In the mountains, south of Monterey, it is also found over a limited area, and again in the lower hills on the east side of the Salinas Valley, near the Rancho Alisal. At this locality it occurs in an extensive quartz dike that has forced its way through all the other rocks both igneous and sedimentary; the forms in which it appears are the blue and green carbonate, in crystals, the sulphuret, the latter found in small masses detached from the gangue. In the same rocks is to be found considerable quantities of iron pyrites, generally disseminated and containing a small quantity of gold. The above ores of copper are often met with in these mountains; their occurrence over so wide a range, and the trappean rocks with which they are so often associated, leads to the belief that at a future day they may be found in sufficient quantity to be profitably worked.

Iron.—This metal is found in almost every variety of form, from one end of the Coast Mountains to the other; the prevailing mineral, however, is the peroxide and protoxide of this metal; the latter is often found in the form of hydrate, and when occurring in proximity to serpentine rocks often found to be more or less auriferous. This mineral is largely developed in some parts of the auriferous district of Mariposa county, and forms one of the most valuable receptacles of gold among the gold-bearing rocks of that section.

Sulphate Iron.—This article, known in commerce under the name of "copperas," is found native in large quantities near the town of Santa Cruz. Its principle had occurred a short distance west of the house of Mr. Medor, in a gulch running from the mountains through the low hills to the coast. I followed the course of the ravine from where it enters the high hill near the crossing of the road north-west of the town to near the sea; the average depth of its banks varies from fifteen to thirty feet, its length from the hill to the coast being about two miles.

The copperas formed an efflorescence on the sides and bottom of the ravine, covering entirely the earth and stones, on which a great quantity had crystallized; it was not difficult to scoop up a pound or more, at any one of these places; the banks of the ravine above the water were covered with the effloresced salt to such a thickness that a white and green color was given for several yards in length, the ground being entirely obscured. The depth of the earth that was thoroughly impregnated with the salt would average ten feet for the whole length of the ravine; the depth to which this descends below the surface is unknown, but it is probably considerable; the rocks at the

bottom are of a micaceous schist, and were broken into for two or three feet, and at that depth seemed as strongly charged with the ferruginous salt as at the surface. A small stream of water runs through the gulch, which is permanent throughout the year, and carries a sufficient quantity to answer all the purposes of an extensive manufacture of this article for commerce. It would be difficult to find a locality that combines the same advantages that this does for the manufacture of sulphate of iron: all that is necessary to be done has been performed by nature, and to extract the salt it is only necessary to erect vats upon the coast and shovel the earth, to be leached, directly into them. An area of several square miles is highly charged with the mineral, and the day is not far distant when Santa Cruz will become as celebrated for the manufacture of this article as it has been heretofore for its vegetable productions.

Magnetic Iron.—At the distance of two miles north-west of the above locality, an extensive bed of magnetic iron occurs, running down to the coast, at which point it crops out and exhibits a depth of several feet. Toward the mountains I have been informed that it again shows itself above the surface in several places; there is every reason to believe that it underlies an extensive district, as much difficulty has been experienced in obtaining correct courses by the compass; in one instance the needle was deflected to thirty-one degrees on approaching its southern edge.

Gypsum.—Sulphate of lime is reported to abound in the northern part of Santa Cruz, and in the vicinity of the Palo de los Yeska, some six miles from the Mission; it was frequently spoken of by the inhabitants of this place, but I was unable to learn its precise locality. It is not improbable that it does abound in this vicinity, as ample material for its formation exists in this section of country. An extensive bed of mountain limestone occurs in close proximity to the native sulphate of iron alluded to in the former paragraph.

Cinnabar.—Has also been reported to have occurred in this vicinity. I found one small piece east of the San Lorenzo on the side of a hill, but it is not impossible that it might have been carried there by human means, as no other mineral of the same character was observed; the occurrence of small detached pieces of cinnabar in these places is not sufficient evidence to found a belief that it occurs in situ, or that a deposit may occur there.

Nickel.—The ores of this metal are found from Contra Costa on the north to the utmost southern limit reached in the Coast Mountains. It occurs in the primitive rocks, associated with chronic iron in almost every case where the latter may be obtained. It appears as a bright green mineral on the fractured surface of the other ores, and is known in technical language as "nickel green." The scarcity of this metal renders the discovery of its ores in this country an object of some importance, and its wide distribution leads to the belief that it exists in sufficient quantities to warrant investment for its extraction from other ores, at no distant day. It is extensively used in the manufacture of German silver for wares and household utensils. When reduced, the metal is white, much resembling silver in its general appearance, and for which it has been mistaken in this country. The principal localities where it has been observed this season are at Contra Costa, in the serpentine rocks south of Tulecita and near San Antonio, in the county Monterey, among the large beds of chronic iron from the San Benito, and the Panoches, of the Gabilan range. These localities afford the largest amounts yet found in this State, and it is to be hoped that those explorations which are now in progress in this part of the country may result in the development of this mineral to a much greater extent than yet known.

Antimony.—The common sulphate of this metal is very abundant in the Monte Diablo Range; at Mount Oso it is found in large masses, also at various other points throughout these mountains; it occurs in considerable quantities in some parts of the county of Santa Barbara. This mineral is deserving of attention as it often contains a notable quantity of silver,

though as yet no specimens which have been been found in this country contain a large per centage of this metal. That variety of the antimonial ores which is argentiferous, has a lively steel-gray color, cuts easily with the knife, and is brittle, while the common gray antimony, which is the principal yet found, has a lead-gray color, its fractured surface easily tarnishes, and scales of the mineral are slightly flexible.

Bitumen.—Bituminous springs abound through the Coast Mountains, and in some places is much used in the construction of buildings, and walks in front of buildings; for the latter purposes it is admirably adapted in situations where the sun will not have too powerful an effect upon it, as in such cases it is apt to become soft. In the counties of Santa Clara, Santa Cruz, and Monterey, several of these springs occur, and further south are found more abundant. Information has been received of an extensive deposit of bitumen in Contra Costa, some six miles from the shores of the bay, but at what point I have as yet been unable to learn. This article has been used of late in the manufacture of gas for illumination, and it possesses some advantages over the common oil or resin gas in general use; a sufficient quantity for the illumination of the country may be easily obtained, and at low rates, when required for this purpose.

Cinnabar.—This mineral is well known, and the principal mine now opened in this country is at New Almaden, in the county of Santa Clara, and situated twelve miles from San José. The town of Almaden is situated four hundred and eighty feet above the sea, and the mine is eight hundred and sixty feet above the town, making the elevation of the mine thirteen hundred and forty-five above tide-level. The ore at this mine is found in bunches or deposits in a clay highly charged with peroxide iron. The cinnabar contains considerable arsenic, generally disseminated through the ore; small veins of calcareous spar are found running through the mineral, giving it at times a fanciful appearance. The magnesian rocks are largely developed in this section, both at the mine and in the mountains to the south-west. The rocks in the immediate vicinity of the mine are talcose in their character, much decomposed and broken up; at the base of the hill on which the mine is located, there is to be found native magnesia on the surfaces of the rocks.

The deposit of ore at this locality is very large, and will require many years to exhaust it. As the mine consists of deposits simply, there is no certainty of its continuance beyond the surface that may be exposed: it has been supposed generally that the ores of this mine occurred in the form of veins, but such is not the fact, and so far as I could learn from the superintendents at the mine, no well defined vein had been found since its opening. The principal adit of the mine is one thousand feet in length, and at the end of this a body of ore fifteen feet square had been exposed in one place; other similar masses, and even larger ones, were laid bare in different parts of the mine. An inclined winze had been driven to the depth of about one hundred feet below the level of the adit, at the bottom of which immense bodies of ore had been found. From the quantity of ore on hand, and that exposed in the mine, the prospects of the Company are highly flattering for a handsome return for the heavy outlays of capital which have heretofore been made. At the date of my visit, the Company were erecting twelve new furnaces in addition to those already in operation, having a capacity for working of twelve thousand pounds per week each, with an abundance of ore in the hacienda for their supply. The construction of their adit and the interior of the mine, with their reduction works, are of a character for permanency, workmanship, and scientific skill to be found only among large mining operations. The ease and regularity with which everything connected with the mine is conducted, argues well for its administrator, and exhibits a thorough understanding of the requisites necessary to insure success in extensive operations.

A better regulated or more systematic method of mining is not to be found in this or any other country, and is well worthy a visit from any who may wish

to obtain an idea of what practical mining is in a large way. At the distance of three miles, another mine of the same character has been opened, but is not in operation at present. This latter is called the Guadalupe; it has not proved extensive up to the present time.

In the lists of minerals appended to this report, will be found more specific detail respecting their distribution among the rocks of the coast mountains. A description of the fossils will also accompany the latter as far as the nature of circumstances will permit. The scarcity of books of reference in this country at the present time, will render it impossible to define all the species that have been secured the past season; the genera will be nearly complete, and in the course of the ensuing season, the species of those genera will be described, as ample works for that purpose will be at hand within that time: there appears to be many that are undescribed in any of the works on hand at present.—*Prof. Trask.*

IRVING'S SAFETY CIRCULATING STEAM-BOILER.

The Statement of Messrs. Cook and Ehman, Civil Engineers, of Experiments upon this Boiler, under the direction of the United States Patent Agency.

The boiler is not a favorable specimen of its plan. It is said to be the first effort of its inventor; and from drawings subsequently made, we plainly see in some of the details, deficiencies supplied and difficulties overcome. It is stated that the furnace of this boiler, at first, was deficient in the supply of air; an alteration, by dropping the grate-bars and cutting a new door space, has been resorted to. The grate-bars are too remote from the heating surface.

The outside diameter of the boiler is four feet, by an extreme height of six feet nine inches; containing a grate-surface of 4.95 square feet. The total and direct heating surface is 169 square feet; there being 95 feet contained in the vertical tubes, 35 feet in the coils, and 39 feet in the fire-box.

The boiler is supplied by a common force pump, actuated by the engine, and receiving the feed-water from an elevated tank.

This tank is of a round form, and represents a regular frustum of a cone; being 4 feet 6 inches diameter at the top, and 4 feet 9 inches at its base, by an extreme height of 6 feet eight inches.

The connections for any further supply having been first interrupted, the height of water was measured, and its surface found to be at a distance of 14 inches from the top of the tank.

At the conclusion of the ten hours, the amount of coal consumed, in converting a given volume of water of 44 degrees into steam of a given pressure, or a corresponding temperature of 304.8 degrees, was 287 lbs.; and the quantity of water thus evaporated, was noticed to be geometrically equal to the solidity of a body having the dimensions of the tank on the original water-surface for its top diameter; 3 feet 7 inches for its height, and a corresponding tank diameter for the base.

By measurement, or by a mere graphical operation, the diameters for top and bottom are accurately obtained, and we find evaporation per 1 lb. of coal to be — 13.003 lbs. of water.

The entire outer surface of the boiler was exposed to radiation; this, together with the improper proximity of the fire, the heating surface cannot otherwise than be productive, to some extent, of loss; and taking into account the temperature of the atmosphere on the day of the test, it is believed that, from two to three lbs. more of water would have evaporated by each lb. of coal; making, at least 15 lbs. of water, instead of the result, 13.003.

At the commencement of the test, the water in the boiler was at the uppermost gauge cock; and at its termination it ranged considerably below this point.

After the test of quantity of coal, water, etc., had been completed, the water was blown from the boiler, the helical coils were disconnected, and

upon a thorough examination, we found not the *least* particle of deposit within, and where the water had circulated. Some cause hitherto not in requisition, must be the theme of curious inquiry as the agent of this effect. Our present opinion is, that the action of water in the coils of "Irving's Boiler" is of a different character and principle; and that this difference, as compared with previous "circulating boilers," is of high consideration. Unlike the plan of straight upright tubes, this presents, in the circulation of water through the helical coils, a centripetal resistance to the centrifugal force; and thereby is induced sufficient friction to preclude the possibility of deposit or incrustation during the action of the boiler.

The inventor claims that its susceptibility of repairs is as great as other modern boilers; and he states that in case of any derangement of the coils, they can at once be disengaged from the other portions of the boiler and let down through the space occupied by the grate-bars; in fact, there is room for such an operation, and it does appear that the requirements of such a procedure are very remote indeed. This operation, however, is of a practical nature, and needs but a moment's consideration of the practical mechanist to settle in his mind its truth.

MINERAL DEPOSITS IN VERMONT.

Brandon is the locality of one of the most remarkable deposits of mineral productions to be met with anywhere. The great marvel in this deposit is that such a variety of useful materials should be yielded from one bed within the compass of a single acre. Just at the foot of the Green Mountains is an extensive district underlying drift earth, which abounds in hematite iron ore. In one place, where shafts have been worked into it—some of them to the depth of 120 feet—are to be found closely contiguous to each other, hematite iron ore, ores of manganese, brown ochre, yellow ochre, kaolin or porcelain clay, quartz sand, and brown coal or lignite.

The discovery of the brown coal at this spot, which is the only carboniferous deposit in the State, was a most important fact in the geology of the United States. It has been investigated with great interest by Sir Charles Lyell and President Hitchcock, and the evidence derived from it induced the latter to pronounce that the whole distance, twelve hundred miles in length, extending from here, through Berkshire county in Massachusetts, as far as Alabama, wherever this brown *iron ore* is found, belongs to the new tertiary formation. The miners suppose that this coal, from the spot where it crops out above ground down to the depth of a hundred feet where they now dig it, stretches perpendicularly in the form of a column. One of the most remarkable curiosities in this lignite is that it contains at least twenty varieties of *fruits* that have been most beautifully preserved from any number of thousands of years back—for the purpose not of being eaten, but that as fossils they might enlarge the sphere of the science of geology in the present age. Similar fruits have only been found at Richmond, Virginia. President Hitchcock was not able to refer them to any living or even fossil species with which he was acquainted. Some of them resemble small pomegranates or medlars flattened, and others nutgalls. I have obtained some for you to use either as a dentifrice, or as an absorbent of acidity, or for the shelves of your cabinet.

By the side of the lignite is a bed of porcelain clay, of about half an acre in circumference, which also apparently extends perpendicularly into the ground for a depth of ninety feet from the surface. The people of the country formerly used it for *putty*, and called the spot the "putty beds." The clay is mostly of the color of city milk—that is, with a shade of blue. It is of the same quality as that of which the specimens from Bennington of Wedgewood and Parian ware are made, and is only waiting for enterprise and capital to be employed in the manufacture of porcelain; and perhaps the tide of free trade will not have set in so fully, strongly, and untimely as to hinder the under-

taking from being profitable. With the help of the pure quartz sand found in beds contiguous to the clay, a company is already engaged in manufacturing in Brandon a renowned fire-brick. The clay itself, after being washed, is disposed of to various classes of manufacturers.

The brown and yellow ochres obtained respectively from washing the manganese and hematite iron ores, are in good demand, because they possess good body, and consume less oil and fade less than those which are imported. The new built houses of the vicinity are often painted with them.

The iron ores are drawn up from three or four shafts 120 feet deep, by steam-power. The water which collects in the mine is fortunately all of it wanted, either for working the clay, washing out the ochres, or supplying the boiler, and as the chain-pump works at the same time with the ore buckets, affords a good example of economical adaptation. There are two blast furnaces for smelting ores obtained in the town, one at Forest Dale, and the other at the Railroad depôt, which belongs to the Iron and Car-wheel Company. This Company in its processes enjoys the advantage of getting from one and the same deposit the two kinds of ores to mix for smelting—the brick with which to build its fire-proof furnaces—of creating its blast from the same water-power with which it washes out its ochres; and uses its own brown coal to generate steam for the engine. It owns ledges of limestone for flux right at hand, and a far-reaching forest for its charcoal. Its pig-iron is melted and cast on the same spot into car-wheels—and only into car-wheels; and while smelting eight or ten tons a day, they still can barely fulfil their orders. I ought not to forget to mention that the peculiar quality of these wheels, which has gained for them their reputation, is their extraordinary toughness and hardness—two qualities so essential for their special object. They have sometimes for a wager been subjected to hundreds of blows with a sledge hammer to crack them, but in vain. The exterior rim is so chilled in the casting that it will resist all efforts to make a mark upon it with any steel instrument. The instrument would inevitably be flattened or broken. Worcester in Massachusetts furnishes, however, the greatest number of the car-wheels used in New England.—*Correspondent New York Times.*

RECENT PUBLICATIONS.

Elementary Geology. By Edward Hitchcock, LL. D. With Introductory Notice, by John Pye Smith, D. D., etc. 25th edition. 12mo. pp. 418. New York: Ivison & Phinney.

The first edition of this work appeared in 1840, and the twenty-fifth has recently appeared. Throughout each of these editions it has been an object with the author to embrace every step in the development of geological facts, and the latest edition is well brought up in its contents to the present time. With the plan of the work our readers are doubtless familiar. It is designed and well prepared to serve as a text-book for students, and a kind of manual for those who have not leisure to pursue the science extensively. It is this adaptedness, and the judicious manner in which the volume has been prepared, which has given to it such success.

Elements of Chemistry. Containing the principles of the science, both experimental and theoretical, intended as a text-book for academies, high schools, and colleges. Illustrated with numerous engravings. By Alonzo Gray, A. M. 12mo. pp. 452. New York: Ivison & Phinney.

This useful edition of chemistry for students has already reached its fortieth edition. It is revised by the author and well brought down.

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GENERAL OBSERVATIONS ON THE FORMATION OF METALLIFEROUS VEINS.* By B. Cotta, Professor at Freiberg.

Volcanic action, either on land or at the bottom of the ocean, does not at present consist merely of eruptions, but also of powerful earthquakes, the formation of fissures, the discharge of gases and steam and the production of thermal and mineral springs. In the same manner it is but reasonable to suppose, that the volcanic action of past periods was accompanied by similarly complicated phenomena. At the same time we must bear in mind that if, at an earlier date in the history of our planet, the atmosphere was more dense, and consequently the boiling point at the level of the sea was higher, and altogether the temperature of our sphere more elevated, the dissolving powers of water were infinitely more powerful than now, and might be compared to those of water at our day in crevices under a high pressure, as, for instance, in the geysers of Iceland.

Under these circumstances it was possible that water could dissolve, both quantitatively and qualitatively, far more substances than at present, especially in the laboratory. The universally high temperature of our globe enabled the water to carry with it, to a higher level, those ingredients which were dissolved in it by heat. G. Bischoff has proved that the constituents of the veins, which resemble those of Freiberg, are soluble in water under certain circumstances and in peculiar combinations. In this respect, I believe, I may refer entirely to the able treatise of this celebrated mineralogist in Von Leonhard's and Bronn's Journal, 1844, page 257, although I cannot agree with his opinion based upon this fact, that *all* lodes originate from infiltration. Bischoff has, however, to my entire conviction, explained the infiltrative formation of the veins analogous to those of Freiberg. It shall, therefore, be my object to exhibit the connection between single known facts and this as well as previous remarks. The former can only be

* Continued from page 392, Vol. III. Translated from the German, by O. M. Lieber.

gradually shown in these numbers,* the latter it will be my endeavor to prove on the spot.

A necessary consequence of the difference of temperature of the crevices, or systems of fissures, at different levels, must have been a continued circulation of the water. Those ingredients, accordingly, which were eliminated from the fused igneous rocks —which we must regard as the primary matrix of metals—the water again deposited at a certain level corresponding to its gradually diminished temperature. In accordance with accompanying circumstances, the precipitation was either energetic or slow, and the result was a massive deposit on the one hand, and on the other a succession of layers. At all times this process must have been unequal at the different levels of the clefts or gashes, and must have depended upon the temperature as well as different power of conduction or chemical affinity of the country.

At the time of the approaching extinction of plutonic action in the whole neighborhood, the operation of cooling depressed the medium temperature at each level, while the lode-forming processes of solution and precipitation continued, so that the zones of unequal deposition were lowered and finally intermixed. If the original inequality of temperature and country was already capable of producing a belted distribution of the material, how much more complicated must have been the result when one of these causes (the temperature) was changed. The same minerals, which in the upper regions appear as marginal coatings of the crevices, might be repeated in the centre of the lode at a greater depth and with a diminished temperature. The effects become still more complicated, when we recollect that very frequently the gashes or crevices in one and the same district were not all contemporaneous, but formed gradually at various successive periods, and even when the process of lode-filling had already commenced; and also, that of those, which originated at the same time, some were filled before the rest. If a certain series or progression of the successively deposited minerals is caused by the gradual decrease of temperature, as is perceptible when we view the lodes from their lower portions up to their original out-crops, it is very evident that the far from coeval origin of the fissures must have caused some to contain merely the earliest mineral deposits, others only the latest, while the contents of a third class embraced a very extensive series. Thus only should we account for the formation of lodes in the separate districts. They are nothing more than the production of unequal stages of cooling in one and the same eruptive and lode-forming process. The frequent parallelism of contemporaneous veins is easily ex-

* Cotta here alludes to the numbers of the work from which this is translated.

plained by the fact that, even at present, earthquakes commonly produce more or less parallel crevices. We need but regard such a vein-bearing district as a territory in which, in the course of thousands of years, various earthquakes, possessing sufficient power to produce these fissures, recurred at distinct intervals.

It is not necessary to regard all those veins as coeval—as resulting from a process affecting the whole surface of the globe at the same time—which in far separated regions present a great analogy of mineralogical constitution and progressive formation. If our supposition is correct, these eruptions are merely local, and the resemblance of their results need only be referred to the similar atmospheric and thermal state of our planet, while the periods in which they occurred may have been very far apart.

The heavy spar lodes near Freiberg, those of the Thuringian Forest, and in the south of France, may belong to very different epochs, and should only be regarded as the results of the same stage of local eruption. The same might be considered as the cause of the regular progression of minerals in veins, vugs, druses and geodes. The same succession may have recurred at distant periods. For this reason no parallelism of age can be drawn from these series, as we are enabled to do with the sedimentary formations on a grand scale. They simply mark the relative age of the single, local creative process.

Let us now endeavor to apply these general theories to the chief phenomena of the Freiberg lodes.

These veins traverse the crystalline slates, especially gneiss, in the same region that the latter are frequently penetrated by porphyries. As a rule, they also extend through the porphyries, and the few exceptions but serve to prove that the porphyry eruptions continued at the time of the formation of the veins. The veins may be divided into three or four groups, according to their strike,* which generally are also distinguished by their age and contents; but it must not be supposed that all veins of the same strike present the same contents, or vice versa, although, generally speaking, this similarity does exist. The lodes of different composition seem as much regulated by their local position as by the directions they take. According to the contents, the lodes may be divided into three or four combinations of different ages, which, however, frequently pass into one another in such a manner that a vein may sometimes contain the production of two or three distinct periods. These combinations are the following:

1. Quartz and hornstone predominate together with acicular, pseudomorphosed breccia of the country. Brown-spar, manganese-spar, calc-spar, strontia, fluor-spar, ruby silver, arsenical pyrites, silver glance, native silver, argentiferous galena, zinc

* See Von Beust's map of veins.

blende, sulphuret of antimony, iron pyrites, and others, appear partly inclosed in the quartz, partly in vugs. This so called "productive quartz formation" is chiefly to be noticed in the fissures of the vicinity of Braunsdorf and Siebenlehn. Nearly a hundred and fifty veins are known to belong to it.

2. Quartz, hornstone, brown-spar, calc-spar and spathose iron ore are intimately united with argentiferous galena, blende, arsenical pyrites, argentiferous sulphurets of iron and copper. More rarely, but especially in druses, we find chlorite, heavy-spar, fluor-spar, antimonial gray copper, ruby silver, &c.; and, on the backs of the veins, as "iron hat," also hematite. This combination has been termed the "pyritiferous lead formation," and occurs chiefly to the east and south of Freiberg. About three hundred veins are regarded as belonging to it, and most of them strike N. 45° E. This combination is intimately connected with the following.

3. Brown-spar, manganese-spar, and quartz, together with calc-spar, heavy-spar, spathose iron ore, argentiferous galena, argentiferous blende, argentiferous iron pyrites, arsenical pyrites, ruby silver, native silver, feather-ore-lead, and others, frequently form symmetrical layers in regular succession. Red hematite appears on the backs of the veins. About three hundred veins, generally striking N. 45° E. or N., belong to this "productive lead formation," and, like the former, are chiefly confined to the localities east and south of Freiberg.

4. Heavy-spar and fluor-spar predominate and alternate in many narrow, regular, and sometimes broken strata, with one another, or with galena. To these are added, especially in the vugs at the centre of the veins, quartz, spathose iron ore, calc-spar, brown-spar, iron pyrites, brown blende, argentiferous gray copper, copper pyrites, light ruby silver, native arsenic, yellow orpiment, sulphuret of antimony, native silver, silver glance, &c. The veins belonging to this "barytic lead formation," which usually strike N. 45° W., occur principally near the Halsbruecke. One hundred and thirty are numbered to this class.

These four combinations or groups should, perhaps, be consolidated into three, on account of the great similarity between the second and third. Their general characteristics would then be:

First combination: Quartz and hornstone, with much interspersed breccia of the country and many precious ores, especially in vugs. The locality is to the north and west of Freiberg.

Second combination: Quartz and carbonic spars, with metalliferous sulphurets, partly massive, partly in layers. The chief locality is to the east of Freiberg.

Third combination: Heavy-spar and fluor-spar, with galena and some other ores, in peculiarly regular layers. This predominates to the north of Freiberg.

This is at the same time a regular progression of age, and it

is easy to understand why the most ancient group is characterized by quartz and fragments of the country, while regular layers are peculiar to the most recent one.

According to our theory, the porphyry eruption was the primary cause of the Freiberg lodes. These eruptions produced the fissures from time to time during a protracted period, and the water (possibly of oceanic origin), forcing its way up from a great depth, dissolved those minerals, which under high pressure, with an elevated temperature and the aid of alkalies, were soluble from the fused masses of porphyry below, for in a few cases only did the porphyry near Freiberg rise to the surface. Bearing with it these mineral solutions, the water deposited them subsequently in its circulations through the upper and cooler regions of the fissures. Among earthy minerals, silica, if in a concentrated solution, was speedily excrystallized, even at a very high temperature. Hence it is, that this acid is chiefly confined to the oldest fissures, to the oldest groups in newer ones, or to those which, belonging to the central portion of a vein district longest retained an elevated temperature. Silica was succeeded, more or less periodically, by the other minerals, according to their capability of being reduced or of congealing; a property, however, which has, as yet, not been definitely proved, although G. Bischoff has already elaborated a great deal that is of importance in this respect.* The precipitations in the crevices were, at first, very energetic and were produced during continued earthquakes —hence the breccia they contain and the massive nature of the contents—while, at a later period, with decreasing temperature, diminished volcanic action and less speedy precipitation, the stratified appearance was gradually developed. Currents of steam and gas may have finally taken the place of the earlier circulations of water, and been the cause of the sublimations in the vugs or more recent crevices and the metamorphoses and translocations of the ancient productions.

If, according to this theory, the porphyries beneath were the original matrices of the contents of the Freiberg lodes, our attention is required for farther proofs, and these may, indeed, become of practical importance. The surest proof would be obtained if we might penetrate in some of the districts, by means of borings or shafts, to a great depth, to examine the metalliferous igneous rocks at a point where their metallic contents would be evident. The *stockwerks*, massive igneous rocks which crop out at the surface, for example the stanniferous ones, or the metalliferous porphyries of Braunsdorf, would be peculiarly well adapted to our experiments. It would be a question worthy to be answered by a country whose mining is one of the chief branches of its industry. It is true that an obstacle would present itself in the

* Journal (Jahrbuch) 1844, page 257.

fact that the very gradual cooling of the large mass would facilitate the precipitation of the metallic particles at a great depth, and thus might prevent their being reached with facility.

Let us now take a retrospect of the whole. Our theory fully explains why the more modern igneous rocks (trachytes, phonolites, basalts, lavas,) are far more rarely accompanied by lodes, than those of more ancient origin, and why altogether lodes are rarely met with in more recent sedimentary deposits, even where these are frequently cleft asunder and penetrated by igneous rocks, as in the Alps. It explains, according to the rules proposed, why at a developed period of the cooling of our sphere that zone of precipitation which decided the position of the chief components of lodes, and which was determined by the temperature, was gradually depressed and sank to a greater distance below the surface. Although the whole process of formation of lodes is still continuing in volcanic regions, its analogy with that of the ancient formation of lodes can only exist at a great depth. But few ingredients are ejected above the surface with recent volcanic fissures, such as silica, calc-spar and oxide of iron, which are found to extend through the lodes of all periods, in part only as the "iron hat," and therefore deposited at the lowest temperature.

The ferriferous veins are the only ones which we can still observe in their nascent state. They are formed in part by sublimation (specular iron ore), in part by infiltration (hematite). These, too, are the very lodes which occur most frequently in connection with the more recent igneous formations, as, for instance, the basalts.

Tin ore and platinum seem scarcely ever to appear in purely infiltrative veins, although the former has been noticed in the copper lodes of Freiberg and the silver lodes of Annaberg, and though it is evident that the hollows in the vesicular crystals of felspar, occurring in the granite of Cornwall, cannot have been filled otherwise than by sublimation or infiltration. These metals may possibly belong to certain massive rocks as accessory admixtures, so that they are capable of being washed from the detritus. The original occurrence they may have in common with other metals, but it would seem to be their peculiarity that they do not occur in true infiltrative veins.

ART. II.—SOME REMARKS ON THE METALLIC WEALTH OF THE UNITED STATES, DESCRIBED AND COMPARED WITH THAT OF OTHER COUNTRIES.*

To the Editor of the Mining Magazine.

AMERICAN mining has undoubtedly now attained a sufficient prominence to excite interest in the political economist, as well as in the geologist. With the most powerful obstacles to contend with, it is gradually rising to that level which the natural merits of our mineral wealth demand. Perhaps no better moment in the past or future history of our country could have been chosen to throw light upon these invaluable resources, than the present. Mr. Whitney has wisely selected the time, and he has laid before the public a work which is exceedingly interesting in a statistical point of view, and we do not hesitate to commend the circumspection with which he has chosen these records, but in other respects a great deal has been left for future writers, not only to enlarge upon, but to correct.

As to the language of the work, I must say that it had always seemed to me one of the noblest characteristics of Anglo-Saxon literature, that the man of science should not leave the merits of graceful style and phraseology to the novelist and poet, but that he should mellow the crudities of astute science by the elegance of the language in which it is conveyed. We find Mr. Whitney's work to abound in exceptions to this rule, and need but call attention to the last sentence on page 51: "The principal one of these is quartz, *which may be said to be almost never absent entirely from any vein.*" The proper application and the true position of adverbs seems, in the author's mind, to be enveloped in a very obscure mist. We might enumerate other instances of the want of a correct application of grammatical or stylistic rules, but want of space and time prevents us, for, after all, the phraseology is of a comparatively secondary importance in a work of the kind.

The first chapter contains a treatise on the formation of veins, though the theories are entirely adopted from an article of the late C. G. A. Von Weissenbach, which is the first one published in Bernard Cotta's studies of veins (gangstudien). We can observe no new remarks, no original investigations, and, by adhering to the hypotheses—and, moreover, to a great extent totally unsubstantiated ones—of one individual, Mr. Whitney has presented a very partial view. All pupils or converts are very easily led to extremes, and become far more decided and firm in their opinions than their teachers. It is very possibly owing to

* The metallic wealth of the United States, described and compared with that of other countries. By J. D. Whitney. Philadelphia: Lippincott, Grambo & Co.

this that Mr. Whitney is guilty of such palpable errors in endeavoring to discover examples to illustrate the theories advanced. Still we would be happy if he would show us a *vein of attrition*, a fissure filled "by fragments of the wall-rock, falling from above, or produced by the friction of the sides against each other." Even if there are such veins they can only be very local, and would belong to the general class of fissure veins. Mr. Whitney has been led away by that over-sorting and systematizing of Weissenbach, which is so peculiar to some German writers, and which leads to the eternal divisions and subdivisions abounding in their works and covering the pages with those categorical distinctions that begin with the Latin numerals and end with the Greek alphabet, after passing through all the intermediate distinctions of numerals and letters of our own. May we inquire, too, why the author, in speaking of *veins of infiltration*, merely refers to those where lime was in solution? Is it only because Weissenbach also omits all other substances? The latter is excusable, because, as Professor T. Reich himself says in the introductory remarks to the article, that paper was not complete nor ready for publication at the time of his death. Not so Mr. Whitney. A gentleman of his extensive experience should be able to fill out the deficient parts of a theory which he establishes as normal. Can it, then, in this instance, be the author's intention to say, that calcareous matter alone produces the incrustations on the walls of infiltration veins (p. 45)? What becomes of the oxides and salts of iron and copper, and what of the numerous other substances that were brought into the fissures in the shape of solutions and there precipitated? Cotta's able article on metalliferous veins would seem to present more substantial theories than those which Mr. Whitney has embodied in his work; and while Weissenbach's hypotheses refer merely to the secondary action, the filling up of the veins, those of Cotta enter into an explanation of the primary cause of the solution of the materials which now compose the lodes. It is true that Cotta only explains the formation of one species of veins, but it is, perhaps, the most important one of all, and, singular to relate, one which has escaped Mr. Whitney's attention entirely, for it cannot be regarded as a subdivision of those which Mr. Whitney terms "metalliferous veins proper," nor of the *segregated veins*, which he defines as produced "by the gradual elimination of their component particles from the surrounding formation." To this class he asserts that the auriferous veins of North Carolina belong. Certainly, if the contents of segregated veins are taken from the surrounding country, the nature of the composition must alter with every change in that of the neighboring rock, and yet we could point out many instances where the North Carolina veins penetrate through the slates into the massive crystalline rocks without any essential alteration in the nature of

their contents. Cotta's theory alone seems able to account for the origin of such lodes, and we are more particularly inclined to apply it to the North Carolina, and, indeed, the infinite majority of Southern auriferous lodes, when we consider the following established facts, viz.: that the character of the veins forms a regular and almost universal series of progression, which begins with the ferriferous quartz, passing downwards into iron pyrites, which gradually changes into various sulphurets of copper; that the gold is most abundant above, and, at greater depths, seems to have had time to settle in the uncongealed mass, and thus to disappear from workable levels.

I have not the space here extensively to enter into Professor Cotta's theory, and therefore refer the interested reader to the translation of his article in this and the former number of this journal.

It must be a matter of surprise to every reader to find that Mr. Whitney makes no mention of pipe-veins. Assuredly they are of adequate importance to deserve some attention, and of sufficient interest to merit a description, particularly as some of the richest Southern auriferous lodes belong to this class.

In speaking of the phenomena observed by Mr. Fox in Cornwall, and by Professor Reich in Freiberg, relative to the effects of electric currents in lodes, we were astonished to find that nothing was said of the very remarkable facts that have been observed in connection with gold, for instance the pseudomorphous crystals of gold upon hematite, with the crystallization of iron pyrites, the accumulation of gold around old roots on the backs of veins, which certainly proves the continued agglomeration, if not precipitation of gold. We would not have expected that Mr. Whitney should have offered an explanation based upon observation, for he shows that he cannot have had great experience in auriferous lodes, but we did certainly expect to find some notice of so very remarkable a phenomenon.

On page 87 I see it remarked that, in the process of the formation of auriferous detritus, "the metallic particles, having by far the highest specific gravity, are first deposited and sink to the bottom, while the lighter earthy portions are carried farther." This is a decided mistake. The metallic particles would certainly sink to the bottom of the detritus with a gyratory or perpendicular motion, but not so by washing away. According to Mr. Whitney, the black oxide of iron, which is much heavier than sand, would never appear on the surface in the beds of currents, and yet, after every rain, we find it above the sand, where the water flowed. The true explanation is this. At first, when the rocks decompose, the metallic particles may occasionally sink to the bottom. The currents of water, bearing the whole along, will, at all events, first remove the lighter portions and afterwards the metals. When these are deposited anew, the last removed

parts will be uppermost. The water, gradually soaking in, or the wind may, indeed, in some instances, carry the heavier particles down through the sand, but they are not thus originally deposited as Mr. Whitney affirms, and, indeed, he will not be able to point out many cases where the bottom of one and the same deposit is richer, for instance in gold, than the upper parts, except where the size of the gravel is variable, for then the coarser portion will be uppermost, and the gold will be found chiefly upon the surface of the subjacent fine-grained deposit, and, therefore, even in this instance, not beneath the whole. It is the same with the Cornish tin.

On page 91 Mr. Whitney remarks, that he is unable to decide upon the usefulness of certain gold amalgamators. I venture to recommend a visit to some of the gold mines, and have no doubt that a decision would be speedily gained regarding inventions which have flooded the country with old iron, and will leave a pleasant riddle for futurity, possibly inducing some remote descendant of our race to dwell upon the bloodthirsty propensities of his ancestors, who have bequeathed to him those huge bombshells that make the mineral regions of the South resemble some Titanic battlefield.

In several parts of the volume the reader cannot fail to notice a want of distinct and decisive geological nomenclature, which may cause many mistakes and certainly should have been avoided. Thus on page 342, a group is denominated "calcareous." At first I was inclined to think of the cretaceous group, but from the connection it must mean carboniferous limestone.

The general information regarding the localities and respective geological positions of metals, is on the whole well selected, but we could not refrain from observing a want of information concerning their recent occurrence. Had Mr. Whitney's desire been only to state the practically valuable locations of metals, none would have been disposed to make any objection, but there are too many exceptions to acknowledge this rule, and therefore I do not hesitate to say that the author should have known and read the interesting work of Sartorius Von Waltershausen, on the volcanic rocks of Sicily and Iceland (Goettingen, 1853) in which the latter speaks of the occurrence of metals in recent volcanic rocks. On page 8 and 9 of that work, we find manganese, titanium, copper, nickel, chromium, vanadium, zinc, tin, lead and silver, particularly enumerated.

I have already mentioned that the bulk of information in Mr. Whitney's work centres around Lake Superior. Indeed, all his remarks concerning the mineral regions of the United States are concentrated on the North; and, while he gives exact statements of the occurrence of some little metalliferous specimen upon a farm in New England, he furnishes the most meagre accounts of even the most important Southern mines. Being a Southerner myself,

I am better able to enlarge upon the want of exactness in the descriptions of Southern mines, than of those of the North. In no part of Mr. Whitney's work can I find even so much as an announcement of the existence of zinc in East Tennessee, where it occurs so abundantly as calamine and silicate. In North Carolina, nine gold mining lands alone are spoken of, and even of these the information refers far more to the capital of the companies and the market value of the shares, than to the practical worth and geological character of the mines. To obtain a truly valuable and complete knowledge of all the mines of such a country as the United States, would require a lifetime and the intellect of a Humboldt, and therefore is more than we can reasonably demand from one individual, especially when we recollect the unsatisfactory accounts provided for the scientific investigator by the majority of common mining reports. These are addressed to men who are supposed to be aware of many little specialities, which are therefore left unmentioned, but without which the uninitiated will fail to comprehend the whole. In addition to this, they are intended for technical purposes alone, and very rarely contain matter of interest to the geologist; besides, they possess the greatest similarity, and usually end with the words, "your prospects are admirable," or, "few mines admit of the anticipation of happier results." It is well known that many of these reports are made without any underground examination of the mines, and I could relate some very ridiculous occurrences with reference to this. Under these circumstances, the author of the work before us should have confined his remarks to the localities with which he was thoroughly acquainted, or should have visited, at least, the most accessible of other important regions, and he should certainly have availed himself of all the information he could obtain. Yet, while he mentions Mr. Partz's report on the Rhea mine, in North Carolina, he is perfectly silent upon a far more accurate one by the same on the Hale mine, in South Carolina, although this is published in the very same number of this Magazine. I can conceive no cause for such partiality.

A matter which does not add to the value of the work is the manner in which the information, which should be classed under one head, is scattered over distant pages. This is owing to the way in which the author has taken up the subject. It would have been infinitely more convenient to the reader, and would have prevented numerous repetitions in the work, if all the mines of one metal, in the same country, had been placed under one head, especially as there is no index; for it is presumed that such a work is intended as a book of reference, and is not to be perused as one would read a novel.

In pointing out the errors which are most perceptible in Mr. Whitney's work, it is by no means the intention to decry it or regret its publication. As a commercial and statistical work, it

is exceedingly useful and interesting, and contains also most valuable scientific information concerning the mines of Lake Superior, and of different parts of Europe. With all its marked anti-Southern partialities, I must still recommend its perusal, for it is the only work of the kind published; and I close with the fervent wish that it may lead to more comprehensive publications.

Art. III.—THE BLOW-PIPE, AND ITS USE IN CHEMICAL ANALYSIS.—No. V.*

4.—TEST IN THE PLATINA FORCEPS.

After having ascertained, by previous experiments, that the substance under examination is incapable, in a heated state, of acting upon platina, a small piece of it—a splinter—is placed in the forceps and heated in the oxidation flame. Substances which under these circumstances affect platina, should be heated on charcoal; or those that are very fusible, in the eye of the platina wire. This is not only useful as a means of ascertaining the fusibility of a substance, but also to enable us to determine the presence of those substances, which under these circumstances would, more or less, color the blue blow-pipe flame. With some of these the color conveyed is yellow, with others violet, carmine, green, or blue. Plattner, in the work cited, gives the following particulars regarding these effects:—

a. Yellow.—Soda and its salts, when fused on the platina wire, at the point of the blue flame, possess the peculiarity of enlarging the external flame and giving it an intense reddish-yellow color. An excess of other salts, whose bases would also color the external flame, though not so intensely as soda, does not obliterate this effect. For the reaction on charcoal see No. IV. When small splinters of silicates containing soda are heated and fused in the forceps with the point of the blue flame, the external flame will be more or less enlarged in the same degree as the substance is fusible and corresponding with its contents of soda. The external flame will also be colored reddish-yellow, and this tint will either remain constant or become more intense with continued blowing.

b. Violet.—Potash and its salts, when fused on the platina wire in the point of the blue flame, give to the outer flame a distinct violet color, with the exception of borate and phosphate of potash. If, however, such a salt contains even a very small admixture of a soda salt, this reaction will be changed to some extent. It is true that near the test a slight violet color will be

* Continued from Vol. III., No. 3, page 268, Mining Mag.

perceptible, but of the intense reddish color produced by the soda. If the admixture of the soda salt amounts to several per cent., the reaction of potash will be entirely suppressed, and the coloring of soda alone will be observable. The reaction of potash is also prevented, when the substance contains a lithioniferous salt in a quantity not very minute. For the reaction of some potash salts on charcoal, see No. IV. Silicates, which contain a considerable quantity of potash, produce a distinct violet color in the external flame only in those cases, when they are perfectly free from soda or lithion and are moderately fusible at the edge.

c. RED.—There are three substances which give a red color to the outer blow-pipe flame, viz., lithion, strontia, and lime. The red is carmine. *a. Lithion* and its salts, when fused on a platina wire, in the point of the blue flame, give a very fine and decided carmine color to the external flame. Chloride of lithium colors most intensely. Considerable admixtures of potash-salts do not prevent this reaction. A shade of violet is the utmost that may be perceptible. Small adulterations of a soda salt are however capable of converting the carmine into a yellowish red. If more of the soda salt is present, a decided reddish yellow appears, which is scarcely distinguishable from the pure soda coloring. For the characteristics of lithion-salts, see No. IV. Many lithioniferous minerals, when fused in the forceps with the point of the blue flame, produce a red coloring in the outer flame. The *Mica* of Altenburg and Zinnwald especially belongs to this class, as it colors the external flame very intensely. This color diminishes, however, as soon as the scale has been fused to such an extent, that it is difficult to protract its fluidity by means of the blow-pipe flame. There are some minerals which present other colorings conjointly with the red one of lithion, and indeed in such a manner, that both colors may either appear separated or mixed. If, for instance, a small quantity of pulverized *Triphylline* (phosphates of lithion, iron and manganese), is treated in the eye of the platina wire with the extremity of the blue flame, a carmine-colored streak, caused by the lithion, is perceptible in the external flame, while this is surrounded by a green one, originating from the phosphoric acid (see further on). It is difficult to observe this in the forceps on account of the great fusibility of the triphylline. Were we to treat the *Amblygonite* from Cursdorf, whose chief contents are phosphates of lithion and alumina, in the forceps by means of the point of the blue flame, we would perceive within the outer flame a yellowish-red cone, surrounded by one of a reddish-yellow color produced by an adulteration of soda. This coloring continues as long as the molten part retains its fluidity. Lithioniferous silicates, which would not, of their own accord, present the red coloring of the outer flame, exhibit this, according to Turner, if we mix in some fluor-spar and bi-sulphate of potash, and then treat it by means of the blue flame upon the platina wire, as is

the case with the regular test for lithion (see further on). *β. Strontia.*—Chloride of strontium, when fused upon the platina wire in the blue flame, instantly produces an intense red in the outer flame. Many other combinations of strontia, as for instance the carbonate (strontianite) and sulphate (cœlestine), when exposed to the blue flame upon the forceps, color the outer flame at first slightly yellowish, but afterwards carmine. The presence of baryta destroys the reaction of strontia. *γ. Lime.*—Chloride of calcium colors the external flame red, but not so intensely as chloride of strontium. Most pure carbonates of lime and compact lime rocks produce at first a slightly yellow color in the outer flame. When the carbonic acid is discharged, however, a red color, though less intense than that of strontia, is produced. The presence of baryta suppresses this reaction, but to this we shall return when speaking of baryta. Fluor-spar, while fusing, colors the outer flame as red as does pure calc-spar. Gypsum and anhydrite produce at first merely a slight yellow color, but afterwards a subdued red. Phosphate and borate of lime produce a green color and not a red one. Tafelspath is the only one of the silicates which produces the correct, slightly red color of lime in the outer flame.

d. GREEN.—There are six substances which produce a green coloring of the external blow-pipe flame. These are baryta, molybdic acid, peroxide of copper, telluric acid, phosphoric acid, and boric acid. *α. Baryta.*—Chloride of barium, when fused on a platina wire with the extremity of the blue flame, colors the outer flame green. At first a pale green is produced, but afterwards an intense yellowish-green. We can best observe this color, if we use but a small quantity of this salt. Carbonate of baryta (witherite), and sulphate of baryta (heavy-spar), when treated with the point of the blue flame upon the forceps, also give a yellowish-green tint to the outer flame, though not so intensely as chloride of barium. The presence of lime does not prevent this reaction, and an illustration may be found in the baryto-calcite, which consists of the carbonates of baryta and lime. This mineral produces a yellowish-green color in the outer flame, but continued blowing will occasionally produce a slight red at the extremity of the coal. *β. Molybdic acid*, or oxide of molybdenum, when attached to the moistened eye of the platina wire and heated with the point of the blue flame, colors the external flame yellowish-green, very much like baryta, while molybdic acid is volatilized. Were we to heat a thin scale of natural sulphate of molybdenum (molybdaenglanz), held in the forceps, with the point of the blue flame acting upon its sharp edge, we would, without producing fusion, instantly color the outer flame yellowish-green by means of the molybdic acid formed. *γ. Peroxide of copper*, either alone or in its combination with some acids, which do not of themselves produce any color,

gives an emerald hue to the outer flame. Amongst these we have the carbonate, acetate, nitrate and sulphate of copper. Metallic copper, when treated on the charcoal with the blow-pipe flame, if it is not entirely protected from the access of atmospheric air, becomes superficially oxidized, and colors the outer flame in the same manner. The combination of copper with iodine also causes a very intense emerald green in the outer flame. Cupriferous lead ores color the centre of the external flame blue from lead (see farther on), and in the outer cone, particularly towards the extremity, emerald green. Cupriferous silicates, when heated by the blue flame in the platina forceps, give the outer flame occasionally a very intense emerald green, viz., emerald copper and silicate of copper. The same coloring also takes place, when oxide of copper forms an essential and the only coloring ingredient, as for instance in calaite. δ. *Telluric acid*, if attached to the moistened eye of the platina wire and heated in the blue flame, melts, fumes and colors the outer flame green. If the telluric acid, sublimed after the treatment of an ore of tellurium on charcoal, is blown upon with the blue flame, it disappears with a green tint, and, if selenium be present, with a bluish-green one. ε. *Phosphoric acid.*—According to Fuchs and Erdmann, phosphoric acid, phosphates and minerals containing phosphoric acid, partly alone, partly moistened by sulphuric acid, produce a bluish-green coloring of the outer flame. This reaction is so definite, that even small quantities of phosphoric acid may be discovered in minerals, when these are pulverized, moistened with sulphuric acid, and introduced as a paste into the eye of the platina wire and then heated with the point of the blue flame. The same may be said of salts, which from the amount of soda or any other coloring admixture that they contain, might not, if treated alone, exhibit the presence of phosphoric acid. If the salts contain water, this must first be removed by roasting or fusing a small test upon charcoal with the aid of the blow-pipe flame. After this, the calcined test should be pulverized, moistened with sulphuric acid, and exposed to the blue flame upon the platina wire. Should such a salt contain soda, we will at first notice a distinct bluish-green coloring of the external flame, caused by the disengaging of the phosphoric acid by the sulphuric, though this is colored by an intense reddish yellow, caused by the soda. Since the bluish-green coloring lasts but a short time, we must observe very attentively whether the outer flame is really bluish-green or not, when we bring the test in contact with the blue flame. Phosphate of lead, as well as green and brown lead ores, if treated alone, color the outer part of the flame green, which is internally blue from the oxide of lead. ζ. *Boric acid*, natural or artificial, colors the outer flame greenish-yellow, when fused in the eye of the platina wire with the point of the blue flame. If this acid, however, is not quite free from soda, the

green color of the outer flame will be more or less mixed with yellow. Borax, when treated alone, does not produce a green color, but, on account of its contents of soda, a yellowish one. If this salt, after having been fused to remove its water and then pulverized and moistened with sulphuric acid, be exposed to the point of the blue flame, an intensely green coloring will be produced for a short time. This will be changed into a yellow one as soon as the salt is decomposed and no more free sulphuric acid is present. Almost all minerals containing boracic acid, when pulverized, moistened with sulphuric acid, and exposed to the blue flame in the eye of the platina wire, produce a green coloring in the outer cone. Another, and indeed a very safe method for discovering boric acid in minerals by the greenish-yellow coloring of the outer cone, has been proposed by Turner (see further on).

e. BLUE.—There are some substances which color the outer flame blue, when heated or molten in the blue flame. They are the following: arsenic, antimony, lead, selenium, and the combinations of copper with chlorine and bromine. *a. Arsenic.* Metallic arsenic and those metalliferous arsenurets, which themselves would produce no coloring in the outer flame, as *e. g.* red nickel ore and arsenuret of cobalt, are surrounded by a light blue shine when heated upon charcoal by means of the blue flame. If the sublimate, produced upon the charcoal by this process, and which is arsenious acid, and hence is very volatile, be blown upon by the blue flame, it will be observed to disappear with a very distinct light blue brilliancy. Arseniates, whose bases do not produce a color in the external flame, as *e. g.* arseniates of nickel and cobalt, ironsinter, when exposed to the point of the blue flame in the forceps, give an intense light blue color to the outer flame. In many cases a blue coloring even then takes place, when the base would produce a coloring of its own, as arseniate of lime (Pharmakalith). *β. Antimony*, in its metallic state, when fused upon charcoal within the blue flame, produces a barely perceptible blue brilliancy round the molten globule. The white sublimate of oxide of antimony thus produced, when blown upon by the blue flame, disappears with a greenish blue brilliancy. *γ. Lead.* If we fuse metallic lead on charcoal within the blue flame, the molten metallic button will be surrounded with a sky-blue brilliancy, while oxide of lead will be sublimed on the charcoal. By heating this sublimate with the blue flame, it may be driven from place to place with the production of a sky-blue brilliancy. Salts of lead, whose acids do not cause an intense color of the external flame, when treated upon the platina wire or in the forceps with the point of the flame, give an intense azure-blue color to the outer flame. *δ. Selenium*, when fused upon charcoal within the blue flame, is volatilized with the appearance of a deep blue brilliancy, and the same may be

said of the sublimate of selenium on charcoal. ε. *Chloride of Copper*, both natural and artificial, when heated strongly upon the platina wire with the blue flame, colors the external flame intensely blue, but afterwards green from the oxide of copper formed. ζ. *Bromide of Copper*, treated in the same manner as the chloride, colors the outer flame at first greenish-blue, and afterwards green from the oxide of copper formed.

[To be continued.]

ART. IV.—THE GREAT SILVER LEAD MINE, SHELBURNE, NEW HAMPSHIRE.—By CHAS. S. RICHARDSON, CIVIL AND MINING ENGINEER.

UNLIKE most mines in the primitive mountain districts, this possesses a secretiveness unusual to those of England and Wales. This peculiar feature in the minerals in this section of country, is one great cause why the lodes as yet have not been publicly known. It is common where champion lodes occur, that they throw to the surface either a gozzan, or some distinct traces of sparry veins, or as is most generally the case, the country in their immediate vicinity is in a decomposed and discolored state; denudation frequently leads to important discoveries, and in the instance now before us, what has been developed may be attributed solely to this cause.

The history of the Shelburne mine, the rich ore the former company raised, and the why and the wherefore they did not succeed in making the adventure remunerative, is quite unnecessary for me to detail; the object of this report is to give an accurate statement of my views on the estate as a mineral property as it now stands, with such suggestions as I may deem necessary to make, relative to its again being worked for its minerals. The mine is situated about the north-west corner of the set, which contains above twenty thousand acres of mountain forest land. The greatest part of it is in its primeval state. At the site and near the present mine, are three large lodes now discovered, which we will denominate as the north lode, middle lode, and south lode; more appropriate names may be given them hereafter. All these are in "Mount Argent," (the name now given to this mountain from its being so very rich in silver)—a small mountain about 650 feet above the valley of the Androscoggin River. The stratum is gneiss, granite, mica, slate, hornblendic slate, quartz rock, green porphyry or mountain greenstone, called in Scotland whinstone, with small bands or veins of trap. The cleavage planes are the same here as in the States of New York, Massachusetts and Vermont, viz., about 25° north-east. There is no regular bearing or dip in the stratified rocks, they may however be averaged at about 55° north-west, and when not influ-

enced by any excess of lateral pressure more than that which is due to the northerly movement, their dip may be taken at an angle of 70° with the horizon.

THE NORTH LODE.

This is a large east and west champion lode about twelve feet thick, having a pretty regular bearing 86° 30′ north-east. Its apparent underlay is three feet to the fathom, or at an angle of 55° northerly. There does not appear to be any perceptible outcrop, but the back of the lode has been denuded by decomposition and a ravine formed by a water-course. This led to the discovery of the lode. It still is crumbling away, but not so rapidly as formerly for a mass of opaque quartz; or otherwise a change in the nature of the lode has arrested the progress of rapid disintegration at the site where the adit level is driven into the hill.

The lode contains at surface two veins, one a small branch, which probably is the foot wall of the lode; the other is the main leader, which is two feet thick, composed of blende, iron pyrites, spathose iron, tourmaline, and silver lead ore with traces of copper.

The engine shaft is sunk nine fathoms perpendicular, and then goes off on the underlay of the lode; the water was worked to fourteen fathoms deep. At five fathoms the lode has been driven on west nine and a half fathoms; here a shoot of ore was met with, holding down but evidently going more to the hill. At the nine fathom level, a level was also driven west under the five fathom level, both on the main leader, and the back stoped away up to the five fathom level. It was in this bank that those large stones of rich ore were obtained. The ore makes in packets as it does in all lodes of a similar character, and will continue to do so until wrought below the valley level, which I estimate at this place at 375 feet or 16 fathoms below the present bottom of the engine shaft, which is said to be 275 feet deep from surface. At the 14 fathom level, two levels have been commenced, one east the other west, on the course of the main vein of the lode; they are respectively 12 and 14 feet in extent. The leader here is looking very promising, the country also is looking much better and appears more congenial for making ore. As far down as this (14 fms.) no cross cut has been driven, consequently the exact width of the lode is unknown; whether there is another vein in the lode or not I cannot tell. I cannot perceive any droppers falling in at present; what the lode is below must be known only by an actual examination. I could not descend any lower for water, but some little knowledge of it may be gleaned from the deads (rubbish taken out of the shaft,) now seen on the rubble pile. From this I gather an opinion that the lode at the bottom of the shaft, be its depth what it may, is certainly much changed from what it is near the surface. By it, it appears the matrix is a soft,

natural, friable, felspathic rock intermixed with greenstone and gneiss, and is impregnated throughout with finely divisible particles of mundic (sulphuret of iron and arsenic) of a most congenial appearance; from which I have every reason to infer that in depth it will become a very strong and productive lode. The leader does not appear at the 14 fathom level to diminish in size, but takes a regular straight course; the matrix is here much more easy for working, and I think the sump (lowermost part of the shaft) would go down with a good speed and not expensive.

The other works on the main lode consist of two shafts that have been sunk to try the lode on the leading vein. One is 75 feet deep, and the other said to be 50 feet deep. Both being full of water I could not examine them. On the western shaft is fixed a very good whim; on the engine shaft, the old whim has been repaired and part of the old four-horse power steam-engine still remains. The water that now comes down the ravine can be easily diverted. It mostly escapes by the upper dam. The water in the adit level will cease to flow, I expect, as soon as the mine is in work. All the mine buildings are in excellent repair, and ready for occupation.

THE MIDDLE LODE.

Very little can be said about this at present, nothing having ever been done upon it. A deep ravine traces its course, running in a regular manner with a well defined north wall; the south wall is positive, but is somewhat irregular. The lode is 30 feet thick, and takes a regular course 72° north-east. It forms a junction with the north lode in the valley about 150 fathoms below the mine. There will be here where the two lodes meet a large concentration of ore, and particularly so should there be a "Flucan" on the south-eastern wall of the middle lode. In some places denudation has taken place as low as 40 feet deep into this lode, and must have been crumbling for many ages. The bounding rocks are mica, slate, and gneiss, interspersed with huge bowlders of solid granite and quartzose rocks, which are strewn more or less over every valley in the mountains. The dip of the lode is southerly, and will form a vertical junction with the great south lode in depth. I should advise some costeen pits (pits sunk at right angles with the course of the lode) put down here in the gully. It can be more easily done in summer, as the brook is then nearly dried up, or if there should be a little water, it may be diverted about a quarter of a mile up the ravine. The geological formation of this ravine may be treated of hereafter, and will be found interesting and instructive.

THE SOUTH LODE

Is a very strong one, and shows well up to the surface. In the western brook it is 12 feet wide, regularly stratified and

highly mineralized. This is the lode opened by Mr. Pasty in the summer of 1853. It can be only seen at this place, for like all the others it is hid from view by the crumbling debris of the mountain. Its apparent bearing is 30° north-east, embedded in an alternating strata of gneiss, greenstone, mica, slate, and granite. Its dip is north-west, about 15 inches to the fathom or towards the middle lode. It carries a vein four feet thick on the foot wall of soft green granite, full of yellow and white mundic, and small strings of blende with traces of blue lead. The centre is a greenstone much approaching to a granite, but with an absence of mica; the remainder is capel (a hard compact dark quartzose rock, usually forming one side of the lodes of tin and copper).

The hanging wall is composed of soft spar, in a state of semi-decomposition. In the brook below the lode are some extraordinary formations of stratified granite. I have often heard of such, but have never seen any before. The granite splits off in a similar manner to beds of sandstone. The slabs are about 14 inches thick; the strata are composed of alternate layers of gneiss, granite, and mica slate. Where the brook passes over gneiss rock that contains mundic, and the rock is in a mass, inclosed in the solid granite, the water wears it away, and forms beautiful little basins, that are as smoothly scolloped out as if they had been cut out by the mason's chisel. In fact, they appear more like the work of man than that of nature. If there were any heavy building stone wanted in the neighborhood, this part of the set would form a most splendid granite quarry. The stone is of the finest and handsomest kind, and the quarry could be opened without the outlay of any dead capital, the strata being all in workable beds, and lying on the surface, and there is no overburden to remove.

But one of the greatest advantages the quarry will possess is that one side, at least, of the stone has a fair face. There then only remains the other to roughly scabble down. There could be a small turbine water-wheel put in the brook, and power would thus be obtained to drive all the drills required, thus saving a large percentage in labor. I firmly believe blocks of granite can be raised from this place, and prepared fit for the stone market, at 25 cents per cubic foot. The brook from here is very precipitous in places, and forms a series of beautiful cascades all the way up the mountain.

On the north side of the lode, and intersecting it in the brook, there is a band of trap rock, excessively hard, full of metal, running nearly north and south. This is intersected obliquely by a thin string or vein of quartz, that completely causes a heave. This shows that the quartz veins are the most modern. The same phenomena occur in several places in this mountain. I have been unable to see what effect these cross causes have on

the lodes, as they are buried beneath the debris of the mountain sides. I am of opinion, however, the lodes are too strong to be affected by them.

If we judge the lodes by these surface indications (and in the present instance that is all we have to go by here, as nothing has been done to explore the mineral products of the lode), I must say I consider this south lode superior to the north. This would form a mine by itself. Water power could be got from the brook to work the mine to a considerable depth. The opening that has been made on the lode at present has not been sufficient to prove what its mineral properties are, and it is difficult to judge the lode by it, but I am somewhat favorably impressed with its present appearance. If it should not change its underlay, it will form a junction with the middle lode about 80 fathoms to the northward. Between the main lodes there is almost sure to be some small lodes, veins, and branches, which in depth fall in and enrich the main lodes. It is a thing totally impossible for any person to state what may be the mineral contents of these lodes, or what may be found hereafter in the bosom of the mountains. We may predict, from surface indication, that there is a large quantity of ore of some kind below, but in doing so, we must deduce a reason. I have, therefore, in the next part, under the head of minerals, somewhat diverged from the usual path of a mining report, for the object of stating my views on the geological nature of the Shelburne mining set generally, but principally as referring to the north lode, as being mostly operated upon.

THE MINERALS.

I have said the north lode will not make any quantity of ore until a depth is attained equal with the bottom of the valley through which flows the Androscoggin River. In making this assertion, I herewith give you my reasons: we find, by a little quiet study on the geology of these mountains, that all the rocks have a very coarse, dry, and barren appearance, and they appear the more so the higher we ascend; that there is an absence of that rich metallic lustre usually accompanying rocks that lie deep, or where they are exposed to a humid atmosphere; the north lode, although so large, it may be perceived, has a very hungry, sterile appearance at the surface, and such a one, that were it not for the regularity of the leading vein, and that so highly mineralized, it must, by the practical miner, be considered and condemned as an unprofitable lode, and not worth being prosecuted. But there are several very important considerations to be taken into account in drawing a positive conclusion as to the real merits of the mineral properties of such a lode.

My views of mineral deposits, in accordance with those of Evan Hopkins, and other mining engineers, are that all mineral deposits, whether in the form of stone, ore, or pure metal, in the

lodes, have at some period been and are forming by water. Water in a state of motion, gentle spontaneous heat, magnetic and voltaic electricity—these are the great agents continually at work in filling up the fissures of the earth's crust, with quartz, alumina, lime, and various metallic mineral compounds, contained in the rocks through which water can pass. Experience has taught us that when lodes are vuggy, open, and porous, they are generally most productive; when they are dry, unless there may be some intervening cause, they are generally poor; when the bounding rocks are hard, so as to intercept the percolation of water freely, the vein is often rich, but not sufficiently so to pay returning cost, in consequence of the hardness of the country. Where great "gulfs" of ore are found high up the mountains, similar to the Ecton mines, in Derbyshire, England, Parys mine, Angelsea, North Wales, and many others I could name, immense concentrations of ore have taken place at an early era, but it forms a mere pocket, and does not hold down. There does not appear any communication with the lode below the water level, and consequently it dies out, or, as miners term it, becomes unbottomed. Nevertheless the hardest rocks are susceptible of absorbing water to a small degree. Almost all primitive rocks, at some period, have contained metallic minerals of some kind. Water will take up the minerals, and hold them for a time either in solution or suspension. Water, more or less, is continually passing through all lodes, fissures, and cross courses. The aqueous currents are actuated in their courses by rarefaction or specific gravity. If spontaneous heat is evolved in one part of a mineral channel, the more dense or colder current will flow towards the lighter, in the same manner as winds traverse the surface of our oceans. Water carrying the minerals with it, when in a partial state of rest, by the agency of the electric currents, allows them to become precipitated, and thus in the course of ages fills up the voids and fissures in the rocks. These fissures are constantly being made in every rocky country. When a rock imbibes water, it imparts to that water a portion of its minerals. External heat and gravitation assist to evaporate from such mineral rocks their moisture; the mineral is dispelled, for with the egress of the water the rock parts with its metallic minerals. Take, for instance, a rock exposed for thousands of years on a bleak mountain summit, like the bald ridge of Mount Washington or Jefferson, and compare it with a rock on the sea-shore. The contrast is perceptible at a glance. The one is dry and barren, while the other is moist, rich, and fertile. So in like manner is a mineral lode. If a mineral can escape to a lower level it will, and there will accumulate, until it fills up the lode or vacancy even to the surface. The great copper mines of Cornwall are true exemplifications of this now well known fact, of daily observation. Of course there are exceptions; there are, as I say, intervening

causes that often arrest such an effect; but how few mines in the world are there that can produce any very great or productive mineral lodes above sea-level. Immediately the miner descends below sea-levels, if the lodes are mineralized at all, there they begin to concentrate their metallic compounds, each, as it were, by affinity to its own kind. The rationale, then, of all this apparent mystery is, that water is the prime mover, the great universal public carrier, never ceasing, never tiring through time.

We now come again to the Shelburne great north lode. The vein or leader of the lode, as well as the lode itself, is seen to be dry in its minerals. Once it was under water. The vein is full of blende. This mineral does not appear to be much affected by water, other than that it becomes deprived of its zinc and sulphur by exposure; the iron and arsenic remains, hence it is left in the lode in its original form. Blende in a lode, under water, is hard and compact; here it is quite friable and appears dried up. The lead in the lode is found in pockets and surrounded by this dry blende, and as the lode opens with the valley no water remains in it. A continual drainage is going on; therefore I infer that this is the cause of the general dryness of the lode. Had it been under water it would have been full of mineral, but they are now gone down to a lower level, and if ever the lode does make, it will be in depth; and that point is below the Androscoggin River. I do not think a fine lode like this can very well fail in becoming productive. It is a fine champion lode, and the bounding rocks are in such a position as to become regular feeders. Had there been a north and south lode, or cross course below, it probably would have been looking more kindly near the surface and carried more lead ore; but I find no trace of such at present. However opposite my views on these matters may appear with those given by the learned professors of geology, I do not know, but they present the only conclusion I can arrive at; if I am wrong, it must be attributed to my want of greater experience. I have nothing more than nature in her crude form for my guide. The south lode is more embedded in the midst of the mountain, and has a brook crossing it at right angles. There are also here some cross veins of trap forming little elvan dykes. This lode is much more likely to make ore above the valley than the others. It is also a long distance from the outcrop in the valley. Nevertheless, I have but very little opinion of its ore-bearing qualifications above water.

THE ADIT LEVEL.

This is driven westerly 75 feet on the course of the main lode, which is much more regular here in its stratification than at any other place. It is composed of opaque quartz with one vein more bright and congenial than the rest; it carries also a slight gozzan with spots of mundic; it is the most favorable looking part of the

lode at surface; it was under this that the shoot of silver lead ore was found to be going down when the mine was suspended by the original company, and it will be in this direction that the future main drivings must be directed.

THE STRATUM,

As described before, is mica, slate, granite, and gneiss. But before closing this part of the report, we must examine the rocks near the mine. We shall there find some very interesting phenomena. There is syenitic granite, gray granite, and quartzose rock, in masses embedded in the gneiss. There are also large masses of coarse granite lying on the mica slate. Who, then, can deny that micaceous rocks, even the schist, are not coeval with the granite? I am led to believe they are all of one common origin; that in the period and form of their crystallization, and in their chemical ingredients alone, they differ, and that there never was anything igneous in their construction.

About 300 yards below the mine is the mill-dam and the stamps, crushers, smelting furnace, &c. At this place it is very remarkable to see the gradual sinking of the rocks, even up to the very summit. As the soft micaceous rocks wear away in the valleys and brooks below, those above that repose on them follow down, leaving great open chasms in the rocks which are filled up with snow and ice, that, with the annual winter frosts, by expansion, are seen splitting their huge gray-capped heads into innumerable fragments. These accumulate until some monster rock of granite overbalances the mass of debris, when it sweeps down the mountain sides with an avalanche, filling the ravines and ledges below. There can be seen the slow but continual change that is taking place in the earth's surface; here can be seen the great northerly movement of the primitive formation, producing immense fissures and opening up new channels for the formation of lodes and cross courses which become the recipients of metallic minerals. These, again, become entombed by the onward moving masses: there they await, still growing, still concentrating, and still enriching, until the time shall arrive when they shall be wanted for the use of mankind. The contemplative mind untrammelled by the dogmas of sectarianism, and divested of abstruse speculative theories, may here revel in delight. Here the visitor beholds the upheaving, the contortions and depressions of strata; here he may look with wonder, awe and admiration, on the sublime works of the Deity, and while he is astounded at the mighty effect, can, at the same time, behold the cause.

PROGRESS OF EXPLORATION.

During my recent visit to Shelburne, time would not admit of my going over but a small section of this extensive property.

I have, however, carefully examined the strata for about three miles up the brook that runs down the pass of Pea Mountain. I ascended as far as the top cliffs that stand beneath the summit house. It is very difficult and laborious travelling; there being no road near the river. The forest is quite primitive. Mr. Buxman, the surveyor of the estate, accompanied me. We ascended about 2000 feet, when our progress was somewhat hastily arrested by a heavy tempest of lightning, thunder, and a deluge of rain. I found no traces of any minerals besides iron. The rock formation is very interesting, particularly about this place, where the basins are some of them very large and deep. I have also been up the Peabody River as far as the Glen House. There are some few traces of mineral channels, but I think it is only iron. I ascended Mount Washington as far as the bald ridge, 4000 feet. This is a hornblendic slate formation, but very dry and barren. I collected some specimens of tourmaline and brown spar, but saw no traces of any thing like a lode. It was very foggy this day, June 15, and although the thermometer stood at 80 in the valley, at this height it was very cold. There were patches of snow in some places 8 to 12 feet deep. The rock formation is quite interesting. I am much inclined to think all the minerals lie on the Shelburne mine side of the river. There is a very large cross course or iron lode crossing the valley, and runs nearly under Mr. Burbank's house. In the second part of my report this will be described, as well as researches in Mount Hayes and the northern part of the set, with a valuation of the ship-building timber thereon; an estimate of the water power of the Androscoggin River; suggestions for the building a manufacturing town; plans of the dam and weir head; estimate of cost in detail for working the north mine; also for working the south mine separately, with other information useful to the proprietors of the property.

ART. V.—THE PROPERTY OF THE PRIDEVALE IRON COMPANY.*
By PROF. WILLIAM B. ROGERS, STATE GEOLOGIST OF VIRGINIA.

THE 5TH, OR BIG COAL GROUP OF ORES.

The *Fifth* and last group of ores included in the Pridevale property, lies in the interval between the Two-and-a-half-feet Coal and the bottom of the Big Coal or Seven-feet vein. With the exception of bands situated near the bottom of the Big Coal, these ores are all limestone ores, or have been derived by oxidation from ores of that class.

The *First* of this group of ore beds has not yet been distinctly

[* Continued from page 370.]

recognized on the north-east, or Pridevale side of the river, but is well exposed on the opposite side, on the old Morgantown road, a few hundred feet beyond the lower ferry house. Its place is well marked by a coal seam of about twelve inches, lying above and separated from it by eighteen feet of yellowish and brown shales. This ore is a sandy argillaceous knotty rock, forming a bed of about twelve inches thickness, bluish within, but rapidly exfoliating in scales of brown oxide. In quality it much resembles the Snake-den ore, but it is more calcareous. Proof is yet wanting of its continuity over any considerable space. The same belt of shales, examined on a ridge about a quarter of a mile higher up the river, disclosed to me very little of the ore. Followed under deep cover, it cannot be expected to maintain its character; but from the absence of the oxide crust, will probably exhibit too large a proportion of the other ingredient.

This bed merits further search on both sides of the river. Its place in the limestone hill would be near its upper end, at some twenty feet above the Coke Railroad.

Contiguous to this coal seam, both above and beneath, a very meagre earthy ore is found, which has been mined at various points, in the hollow north of the Coke Yard. This is associated with calcareous shale and fire-clay, and consists of mere shells of ferruginous sand and clay, too poor in iron to be worth mining. I will therefore not enumerate this as one of the available ores.

At a level from twenty to thirty feet higher than the Small Coal already mentioned, and separated from it by shales, sandstone and a considerable bed of yellowish limestone, we meet with a very remarkable ore bed, which has thus far, however, proved too thin to be of much value. This is wrought by a drift on the eastern flank of the Big Coal hill. It is associated with calcareous shale and impure limestone ore, but the band itself is a very ponderous nodular ore, of a deep colcothar brown color, so rich and pure, that if reduced to powder, it would, no doubt, form a good pigment, similar to Spanish Brown. Its thickness, thus far, has not averaged more than two inches.

Above this level, the limestones and limestone shales which occupy a good part of the next one hundred feet of strata, present, where decomposed by exposure, shelly fragments of yellowish and brown earthy ore; but these being the product of purely surface action, give no true evidence of beds of ore. At a still higher level, within thirty feet of the bottom of the Big Coal, occurs another thin plate of coal, below which, in the fire-clay shales, we meet with irregular courses of limestone and of ore. These materials are exposed in numerous diggings near the crest of the limestone hill, and again on the road approaching the Big Coal. Some thin plates of rich carbonate have been found in the shales occupying this position, at one or two points in the

limestone hill; but here, and at the openings near the Big Coal, the ore is principally made up of concentric shells of earthy brown oxide, with large interspaces occupied by yellowish clay and sand. Where freed from the great excess of earthy matter, this ore will be found valuable for mixing with heavier and more refractory materials. A similar but richer ore, having the same geological position, has been opened by Moore on his own land, adjoining Hastie's on the opposite side of the Cheat. These ores being, I think, in great part the product of a decomposed ferruginous limestone and shale, lying near the surface, will become poorer and more calcareous when followed under a deep covering of rock; but in the localities mentioned, they range for a wide space near enough to the surface to retain their character of oxide ores.

I now come to the *last* belt of ores of this group: that included in the fire-clay and shales, extending below the Big Coal, through a depth of from twenty to twenty-five feet. This, at some localities, is a belt of great importance, as well from the persistency as the richness of the ore. At Oliphant's Furnace, north-east of the Anna, about seven miles, it consists of a fine-grained, compact, rich nodular or plate carbonate of iron, from five to six inches thick, within a few feet of the bottom of the Big Coal. Similar plate and nodular ore has been mined beneath this coal, on the hill of the Eclipse Rock, below Pridevale. Under the mouth of the coal mine, two drifts have been carried for a short distance into the shales under the Big Coal in search of ore. The lower of these exposed a plate of very rich *blue carbonate* or *Oliphant ore*, but too thin to encourage further pursuit. In the upper drift, the roof of which is a foot or two below the bottom of the Big Coal, the light bluish argillaceous shales include several scattered courses of small nodules, and one course of large suggans, all of a bluish-white color, and rich in carbonate of iron. Near the coal openings, these shales have, by strippings, furnished a large proportion of similar ore; and at the mouth of the coal mine, a ditch, recently dug for the purpose of draining the works, in penetrating the fire-clay shales for some three or four feet below the coal, has disclosed the same nodules and suggans. Judging from the amount of ore seen at these openings, I would estimate the contents of the fire-clay shales, in a depth of six feet, in this particular locality, as equivalent to a plate of ore of about eight inches.

On the neighboring coal hill, a distance of about fifteen feet below the coal, benchings are now in progress which furnish a coarser ore of the same description, which, from the name of the operator, may be designated as the *Collins Ore*. These openings display scattered nodules of heavy blue ore, forming from three to five courses in a thickness of five feet of soft, crumbling shale, and beneath these a mass of flaggy ore, in thick plates separating,

with rounded edges, sometimes covered with a dark brown scale. The whole thickness accessible in these openings, is from nine to twelve inches, the greater part of which is a moderately rich carbonate ore. As this ore is obviously a laminated shale, heavily charged with *carbonate of iron*, and is therefore part of the original stratification, there is no probability of its being changed in quality when traced inward from the outcrop, more than in any other direction; and there is therefore good inducement for hereafter following it into the hill by drifts.

As the area underlaid by this ore on the Pridevale property is not very extensive, even supposing the ore to continue equally valuable throughout, I have made some examinations on the opposite side of the Cheat River, on the lands of Hastie, Stilwell, Haco and Coombs, to learn its range and probable thickness in that direction. At Hastie's and Stilwell's, a rich nodular carbonate is found, in the shales beneath the Big Coal; but the absence of any regular openings prevented my learning any thing definite in regard to the number and thickness of the layers. On Haco's land, it has been imperfectly exposed on the margin of a small brook, and is said by the proprietor and others to occur in two courses, of which, however, I could see but one. This is from one and a half to two inches thick, and is of the very finest quality of blue carbonate. On the margin of another brook, but a short distance from the preceding, on Coombs' property, I found, in place of the shales, a band of similar ore, varying from three to five inches, and numerous fragments of the thin plate ore, which obviously lies a few feet below the other. In this locality, therefore, six inches of the heavy fine-grained carbonate, or Oliphant ore, are accessible. The distance of this point from the Anna Furnace is something more than one and a half miles. These ores, if present in the neighborhood of Woodgrove, are of course confined to the range of the Big Coal, which lies high in the hills adjoining the Cheat River, and therefore beyond the Pridevale tract.

GENERAL REMARKS ON THE ORES.

It should be borne in mind, as a matter of much economical interest, that the ore formations consist of shales and shaly sandstones, containing a general impregnation of carbonate of iron, which, in particular layers, becomes the predominating ingredient, forming flags and nodular courses of good ore; and that as the ore graduates by insensible degrees into the shaly mass, much skill and vigilance will be necessary to prevent the substitution of a merely ferruginous rock for the ore, which it so much resembles.

It should also be remembered, that the productiveness of an ore bed along the outcrop, where mined by stripping or shallow benching, does not necessarily increase, as often supposed, or

even continue the same, when the ore is pursued by drifting under a deeper cover of rock. As a general rule, the brown oxide ores of the coal measures are the product of chemical changes, due to the access of the air and water to the blue nodular or carbonate ore, which appears to have been very generally the original form in which the iron was accumulated in the carboniferous strata. Hence, when followed far under the rocks, these *Brown Ores*, or *Limonites*, are commonly, although not always, seen to pass into the condition of blue nodules of carbonate, with ochreous scales, and finally into the solid and unchanged blue lumps.

The *Brown Ore*, when tolerably free from earthy matter, is richer in metallic iron than the best blue lump met with in the coal-measures. The former often contains more than one half its weight of metal; the latter is of good average quality when it attains to one third. In the case of the Haines Ore and the Snake-den Ore, the form of the ground along the outcrop is such as to afford a comparatively wide belt, under shallow cover, and thus to favor the complete oxidation of the mass, even for some distance within the immediate line of outcrop. Similar remarks are applicable to the limestone ores. These being principally derived from beds and nodular courses of limestone, highly charged with carbonate of iron, are found, at and near the outcrop, to consist of a light brown ore, generally in irregular concentric shells, including earthy matter, the residue of the limestone after the solution and removal of its carbonate of iron. When pursued under deep cover, such ores may be expected to pass into massive unchanged limestone rocks.

The *blue nodular carbonate* and *plate ore*, being an original constituent of the strata, is not necessarily subject to change of composition when followed under cover by drifting, but when thus explored, will show only such alterations of thickness and purity as belonged to it when first deposited or collected by segregation in the strata; such will be found to be the result with the Redbelt and Martin ores, and with the Carr and Stratford and Collins beds. In these cases the only change to be anticipated, is the disappearance of the brown oxide scales which usually inclose the lumps and plates, at and near the outcrop, and these, in the cases mentioned, form an inconsiderable part of the mass. The Snake-den Ore, being in its unchanged condition a rocky, bluish carbonate of good quality, may be expected, even when pursued far under cover, to retain its value as a carbonate ore; but will, of course, be less productive than an equal weight of the brown oxide, into which it has been transformed, along the outcrop and under shallow cover.

As a general rule, it should be remembered that the shales with which the ores are almost always associated, are softer and more easily mined along the outcrop than under deep cover,

and hence, usually, the ores can be obtained at less cost by stripping or shallow benching, than by mining in drifts. The relative cost of the two methods will, of course, depend not only on the nature of the material, but upon the comparative proximity to the Furnace of the respestive mines. It will be seen in the details already given, that many of the principal ore beds of the Pridevale tract, have already been stripped and benched over a considerable extent of their outcrop. *But even in these cases, long lines remain untouched, while, as regards some other layers of ore, little more than a beginning has been made in surface mining. The Red-belt and Martin ores, the two principal Stratford ores, the Swisher and Haines ores, the Snake-den and the Collins ores have each in reserve a long line of outcrop, portions of which will be within convenient reach of each of the three Furnaces.*

The Anna Furnace is more remote than either of the others from most of the productive openings now mined. But it will be seen, by inspecting the *transverse section* B, that between the Furnace and the mouth of Quarry Run—a distance not exceeding one mile—the ores of the lower and middle groups lie in a series of parallel north-west dipping layers or plates, extending from their outcrop on the brow and slope of Laurel Hill, down to the river level, and therefore, presenting their edges along the side of the mountain which fronts the river. Here is an important field for exploration, and should the Martin, Stratford and other ores at these points, prove as good and abundant as at some of the remoter openings, it may be found more economical to obtain the ores by drifts, entering along or near the base of the hill, and near the Furnace, than to transport them, although more cheaply mined, from the distant outcrop openings.

OF THE COAL SEAMS.

Including the numerous thin beds or plates of coal, which, at various intervals, are interpolated in the rocks of this district, we may enumerate twelve and perhaps thirteen distinct *Coal Seams.* Of these, however, only *five* are to be regarded as of any economical value, viz.: the *Norris Vein*, the *Blacksmith Vein*, the *Two-and-a-half-feet Vein*, the *Four-feet Vein*—marked five feet in the section—and the *Big Coal*, or *Seven-feet Vein.* Among them, the last two mentioned are by far the most valuable. A brief reference to the more marked of the others, however, cannot be without interest and importance, since even a thin plate of coal is often a most valuable guide in seeking for ores, and in determining their geological position.

The *lowest two seams* are associated with the Stratford Ores—the lowest of all being a few feet beneath Carr's Ore, and the other between this and the old Stratford Ore. Of these, the former alone appears to attain considerable thickness, having at some points, according to Carr, a breast of about three feet; but

of this measurement I have no evidence from my own observations. *The Norris Vein*, at its outcrop in the ore and whetstone diggings, I found to measure more than four feet; but this is, no doubt, beyond its average thickness, and is, moreover, inclusive of a good deal of carbonaceous slate. Of the quality of this coal I cannot speak, as it appears never to have been brought into use; but on the outcrop I found it to be slaty. *The Blacksmith Vein*, where mined at the crop on the hill side, southwest of Sheet's Hollow, was about eighteen inches thick. It was greatly esteemed for blacksmith's use, and was resorted to before the discovery of the larger, or *Four Feet Vein* above it; of its persistency in quality and thickness, I have no means of forming an opinion. All these coals would descend below the level of the Cheat, east of the Furnace, and at distances as indicated on the *Horizontal Section*, more and more remote, in proportion to the lowness of their position in the series of inclined strata. *Each of them, however, in its extension upwards and laterally, would underlie a very large area on the Pridevale estate.*

The vein called the *Four Feet Vein*, is unquestionably the most important belonging to the property, extending, as I think it does, from the Anna Furnace to Woodgrove, and spreading upwards with the rise of the strata eastward, so as to underlie a zone of many hundred, and probably more than a thousand acres. In the neighborhood of the Anna Furnace it consists of two benches, divided by a thin and variable layer of carbonaceous slate—the lower bench measuring three feet two inches, the upper sixteen to eighteen inches. At Barney's, on the flank of the mountain, its thickness appears to have been about the same. In the neighborhood of Woodgrove it is somewhat thinner, and, owing to a slight dislocation, connected with an undulation of the strata near the furnace, the coal has been pinched and disturbed by the adjacent heavy rocks.

At Beatie's drift, adjoining the Furnace, it yielded only two feet of coal. In the drifts north-east of this, it is said to have varied from two and a half to four feet. During the summer, when steam-power at Woodgrove takes the place of the water-power of Middle River, this coal has, I learn, been found very efficient in driving the engine; and for such an use, the supply of coal from it would, I think, be ample, without resorting to the big seam on the river hill, a mile below.

In future mining, however, I would suggest opening the seam some distance up the valley north-east of the Furnace; as by that means, not only would a greater area of the coal be conveniently commanded, but the workings would be less influenced by the undulation which traverses the strata in the vicinity of the Furnace. Like all the coals uplifted by the arch of Laurel Hill, the coal of the four feet seam has a strikingly cubical fracture. No analysis has yet been made, to determine its ash, bitumen, &c.:

but judging by its appearance, I would rank it among the coals having from twenty to twenty-five per cent. of volatile matter. Whether it is sufficiently dry coal to admit of being used in the raw state in the reducing furnace, can only be determined by trial.

Of the extent to which the mining already conducted in it, has exhausted this plate of coal, I have no means of ascertaining; but from what I have learned of previous workings, I presume that no great impression has been made on the mass. Hitherto, the mining has been confined to the lower, or three feet bench, the dividing slate serving as a good roof for the works. *The Two-and-a-half feet Vein*, lying from one hundred and fifty to one hundred and seventy feet higher in the strata, descends to the Cheat River near the Foundry, and has been opened by benching, and by drifts in the low, terrace-like hill which is prolonged from the Furnace westward. The same vein is also wrought for local use, at several points in a north-easterly direction, between this and Woodgrove. It shows itself in a heavy smut on the road three-quarters of a mile south-west of that place, and is, I conceive, identical with a seam which has been drifted on in the valley of Middle Run, half a mile below the Woodgrove Furnace.

Passing over the two or three thin and variable plates of coal that intervene, I come now to consider the *Big Coal*, or *Seven-feet Vein*. This fine coal seam, wherever it occurs in the Monongahela Valley, is marked by an overlying thick mass of heavy bedded coarse sandstone, capping the high hills, and in many instances forming a lofty cliff impending over the mouth of the mine. Its available thickness of coal varies, in different neighborhoods, from six and a half to nine feet. In the drifts below the Eclipse Rock, where I measured it, I found the main or lower bench, at different points, 5.5 feet, 5.8 feet, 5.9 feet, and 6.4 feet, and on an average in this hill, not less than five feet ten inches. In this bench there are no slaty partings, except one very thin film, near the top. Generally, above the main bench there is another of considerable thickness, with a thin layer of slate interposed, and still higher, two other much thinner plates. By the disappearance of the lower slaty land, the two are thrown into one unbroken mass, and sometimes the upper slates also disappear, and the seam assumes its maximum dimensions. At the mouth of the drift above mentioned, the following measures were taken in the descending order:—

Plate of coal,	6 inches.
Slate,	2 feet.
Coal,	9 inches.
Slate,	18 "
Coal, upper bench,	21 "
Slate,	2 "
Coal, main bench,	5 feet 9 inches.

The coal of the Big Vein is highly bituminous, flames abundantly, and produces a good coke, the value of which has been already tested in the furnace. The area of this coal seam included in the Company's property is in all about sixteen acres, ten of which are in the Big Hills, and the remainder in the adjacent height above Collins' ore banks.

The river hill, about one mile north-west of Woodgrove Furnace, and beyond the limits of the Company's land, contains an area of about six acres of the same vein, the mining right of which belongs also to the Company. This, in connection with any future extension of the operations at that furnace, must prove a very valuable resource. At the mouth of the mine, on the hill side fronting the river, I found the bed nearly horizontal, with a slight declension towards the south-east. The face of the seam presented the following divisions in measure:

Plate of Coal,	7 inches.
Black Slate,	18 "
Plate of Coal,	6 "
Black Slate,	17 "
Main Coal.	6 feet 2 inches.

OF THE LIMESTONES.

In the lower division of the coal-measures, including, as already defined, all the strata from the base of the great Conglomerate to the top of the Four-feet seam of coal, no considerable masses of limestone are found anywhere in the coal basin in Virginia or Pennsylvania. But limestone strata exist at some depth below the Conglomerate, and also in the higher divisions of the coal-measures, both below and above the main upper coals.

On the land of the Company, the limestone rocks of both these geological belts exist in ample abundance: using the ascending order, I shall speak first of the limestone below the Conglomerate. This lies at a distance of several hundred feet beneath that formation—from which it is separated, as shown in the section, by the group of Martin ores, and the underlying red and variegated shales and sandstones. It is seen cropping out at some points in the mountain slope, eastward about a mile from Quarry Run, whence it has been obtained for the Henry Clay Furnace, and is well exposed in a low north-west dipping shelf, on the opposite side of Cheat River, about half a mile above the mouth of this stream. It forms a low and very broad anticlinal arch, in the heart of Laurel Hill, rising towards the Raven Rocks, in a line of cliff, far below the great Conglomerate, and then gently descending, farther up the stream, to disappear below its level, towards the opposite or south-east side of Laurel Hill. Where fully exposed, its total thickness would amount to about one hundred feet, including in this estimate the lower sandy and shaly beds. But the upper portion of the mass is a pure, light

blue compact limestone, including some beds which are crowded with shells and other marine animal remains.

This rock is well suited as a flux, and burns into a pure white lime.

The limestone of the lower coal-measures consists of irregular thin beds, which are not continuous, usually found in two positions, the one below the so-called Limestone Ore and Coal, and the other below the Four-feet vein; the former is found in Sheet's Hollow, but is not continued to the road where the Coal and Ore show their crops. The latter is absent in the neighborhood of the Anna Furnace, but makes its appearance beneath the Three-feet coal (the equivalent of the Four-feet), at and around Woodgrove. As we approach the Two-and-a-half-feet vein of Coal, the shales begin to show a marked proportion of diffused calcareous matter, and to contain knots of impure ochreous limestone, which, at some localities, as at Baker's, form one or more continuous bands of a shaly limestone rock. About eighty feet higher than this, irregular courses of yellowish limestone present themselves, and we now pass into an alternation of yellowish and bluish limestone, and variously colored shales and sandstones, in all, a thickness of limestone rock of about twenty feet. Above this, but still beneath the Big Coal, are two and sometimes three thin and very variable courses of shaly and ochreous limestone, associated with the shelly and earthy ore beds of this division of the series.

All the limestones of the belt last spoken of, are of the argillaceous kind, and *all of them contain carbonate of iron.* In most of the layers, the latter ingredient is in such large proportion as to impart an ochreous yellow color to the surface, after exposure to the air. In many cases, the more thorough decomposition of the rock gives rise to a yellowish brown crumbling earthy mass, which is in fact a very meagre iron ore. The bluish limestone, which, after being some time exposed to the weather, contracts but little of this ochreous hue, is generally the purest of these varieties of the rock, but either will be found to serve well as a flux in the reducing furnace.

Judging from some experiments which I made several years ago on limestones from the same belt in another neighborhood, I think it probable that some of the bands above referred to, would furnish a *valuable hydraulic lime.*

OF THE FIRE-CLAY AND WHETSTONE.

Beneath each of the coal seams, small as well as great, is found a stratum of fire-clay. This, when pure, is a very intimate mixture of alumina and silica (pure clay and sand), and when of fine texture, is an admirable material for the manufacture of *fire-bricks* and *crucibles.* A compact variety of very even and fine texture occurs, associated with the Norris Ore and Coal,

and has been extensively used in the manufacture of fire-brick at the Ferry. It has sometimes a hardness approaching that of rock, and is known in the neighborhood by the title of *Whetstone;* but a more appropriate name would be indurated fire-clay. The bricks made from it have been found of excellent quality.

The Norris bed has as yet been opened only along the face of the mountain, at the distance of more than a mile from the Furnace; but its dip must bring it down the side of the hill below the turnpike, within a third of a mile of the Furnace; and I have already satisfied myself of its existence in this position.

Besides the Norris bed, other strata of fire-clay of available character may be resorted to when needed.

ART. VI.—NITRATE OF SODA.—ITS ABUNDANCE IN SOUTH PERU.*

Tarapaca, the southernmost province in Peru, is situated between latitude 19° and 21° 30′ S.; the Andes on the east, which separate it from Bolivia, and the Pacific Ocean on the west.

This province possesses many points of interest to the naturalist, and affords perhaps as interesting a field for research as any other portion of the continent of South America of the same extent. It forms a part of the great desert of Atacama; but though entirely destitute of vegetation, excepting in a few spots which are irrigated by water derived from the melting snow of the Cordilleras, it is much less desolate and lifeless, in its general aspect, than that portion to the south, which forms the western part of Bolivia and the northern part of Chili, where the oases are more widely separated, and throughout a large tract of country no living thing is to be found.

Two ranges of mountains and a plain, nearly level, extend north and south throughout the province; and between the Andes and the eastern chain of mountains lies an extensive plain inclined to the west. The surface of this latter plain is broken by numerous streams from the Cordilleras; it is formed of debris from the Andes, and is covered by huge angular masses of feldspar and trachyte, and numerous fragments of pumice and grains of sulphur. Among the neighboring mountains are seven or eight volcanoes, some of which occasionally emit a small volume of sulphurous vapor. Parts of this plain afford support to coarse grass and bushes; one kind of cactus grows rankly, attaining the height of eighteen or twenty feet, and a foot or more in di-

* From an article entitled "Geological and Miscellaneous Notice of the Province of Tarapaca. By JOHN H. BLAKE," in Silliman's Journal.

ameter. It is collected by the inhabitants, and being split, serves for doors and rafters to their houses.

The range of mountains bounding this inclined plain on the west, and separating it from the great pampa, or plain, of Tamarugal, is composed of sandstone, with beds of gypsum, and is intersected by deep and abrupt ravines, some of which extend to the sea, while others terminate on the eastern border of the plain. The range of mountains on the western side of the pampa of Tamarugal is composed of feldspar-porphyry, resting on granite. The base at the west, in many places, is washed by the Pacific Ocean; but in parts of the coast, as at Iquique, a plain of several square leagues intervenes, composed of shells adhering together, and of the same species as now exist in great numbers on the shore. The greater portion of these shells are partially decomposed, and may be easily crumbled to powder, while many of them are perfect and bear no marks of abrasion. Inland toward the mountains they form a compact uniform bed, scarcely a trace of the original shells being discernible, and as we approach the shore the forms become gradually more distinct till we meet with the living shells on the coast. Near the mountains the plain is covered with fine silicious sand, the position of which is constantly shifting by the wind, forming hills of considerable elevation, and presenting a great variety of beautiful plains and curves.

The pampa of Tamarugal, lying between the two ranges of mountains before mentioned, is from three thousand to three thousand five hundred feet above the level of the sea. At the north it is bounded by a similar plain of greater elevation, and at the south by a deep and broad *quebrada*, through which runs an inconsiderable river, called the Loa. The surface presents clay, sand, gypsum, and common salt, mixed with nitrate and sulphate of soda. The three former substances, separately, cover large tracts of country, as do also the latter, united in various proportions, and nearly free from earthy matter. In some parts of the pampa, particularly at the south and east, the beds of clay are many miles in extent, and present a surface uniformly smooth and level, and so hard that when riding over it the hoofs of the mules make no impression. On the eastern side, further north, the surface is sandy, and scattered over with numerous fragments of pumice, basalt, chalcedony, carnelian, and agate. Between Matilla and the mountain of Chalacollo, the soil is covered in several places with calcareous tufa for the space of an acre or more. Shrubs are here standing in the same position in which they grew, the smallest twigs remaining, presenting the singular spectacle of a once rank and luxuriant thicket converted into stone. Gypsum, more or less mixed with fragments of shells and marl, constitutes a large part of the surface of the pampa at the north. In the extreme northern part it presents a very remarkable appearance, being in flat rounded masses, slightly con-

cave on the upper surface, from five to fifteen inches in diameter, and from one to two inches in thickness. They are compact and hard, and contain a few minute fragments of basalt. The same form also occurs in the beds of salt, which likewise constitute a large part of the northern section of the pampa, but in much larger and less regular masses; presenting on a grand scale the same appearance which is observed when evaporating saline solutions, where pellicles form, and fall to the bottom of the vessel. These cakes of salt, many of them five or six feet in diameter and a foot thick, contain little insoluble matter; they lie piled one upon another to the depth of several feet, presenting a rough, white, and glistening surface, over which the traveller may ride all day without his horse's hoofs once touching the soil. Although more abundant at the north, these unmixed beds of salt are found in other parts of the province.

In the western part of the pampa, in latitude 19° 50′, at an elevation of about three thousand five hundred feet above the sea, and about two hundred feet above the adjoining plain, limestone, containing shells, rises from a bed consisting of pebbles and shells which are cemented together by salt, principally nitrate of soda. Part of the shells are decomposed, while others are perfect in form, and like those still found living on the rocks in the inlets of the sea. The same variety of limestone occurs on the opposite side of the mountains, near Molle, and is traversed, as is also the feldspar-porphyry of the neighboring mountains, by veins of the same salts which unite the shells and pebbles of the plain. Among the sandstone hills on the opposite side of the pampa, particularly in the vicinity of Pica, similar veins of anhydrous sulphate of soda occur. Many of them are a foot wide, and can be traced for several hundred yards; they are compact, hard, and dry, and at a little distance resemble veins of quartz. Barely a trace of insoluble matter was found in specimens taken from different parts of several veins. Some of the cavities afford small rhombic crystals.

In the northern and eastern parts of the province are numerous quebradas, or abrupt ravines, commencing at the base of the Cordilleras and extending in a westerly direction; some of them intersect the pampa and both ranges of mountains, others terminate at its eastern border, dividing the eastern range only. Numerous similar ravines intersect the country situated between the Andes and the sea, both north and south of the province we are describing. A remarkable feature disclosed by them is a difference of level on the sides, which has evidently been occasioned by the upheaving of the one or the subsidence of the other.

These quebradas vary in depth from a few hundred feet to three thousand feet below the level of the plain, and in width from a hundred yards to five or six times that distance. The

bottoms are covered with sand and pebbles, bowlders of porphyry, feldspar, and granite, and huge angular fragments of trachyte, sandstone, and gypsum. In various parts of these ravines, where the rock is exposed, both on the bottoms and on the sides, are deep scratches or grooves, running in the direction of the ravine. The sides present bold precipices. On those of the quebradas which terminate at the border of the pampa, near the mountain of Chalocolo, water lines are plainly discernible; and the crevices in the rock, at an elevation of several hundred feet above the plain, are filled with the same kind of clay which covers for miles this part of the pampa.

The quebradas are generally barren; but in some parts of that of Pisagua, *alfalfa* is raised in considerable quantity. In the eastern parts of those of Camarones, Chisa, Pisagua, and Tiliviche, are small streams which take their rise in the Andes; they are absorbed or evaporated before they reach the sea.

Beneath the surface of a part of the pampa, lies an extensive forest of large trees, all of which are more or less inclined to the southwest. They are, for the most part, of the Algarobo species. The wood is dark brown, inclining to red, and very brittle; it burns freely and with little smoke, although it contains a large portion of resin. Parts of some of the trees have the appearance of having been charred. From latitude 20° I have traced this forest for nearly sixty miles in a southeast direction. About thirty miles further north, trees have also been discovered, and it appears not improbable, that the whole of this now barren plain was once a fertile and thickly wooded valley. In some places the branches of the trees are near the surface; and often, receding from these points in all directions, they are found more deeply buried, indicating an uneven surface of the valley in which they grew.

By sinking wells through the saline soil of the pampas, water has been found in some places at the depth of ten or twelve feet, while in other parts excavations have been made eight or ten times this depth without meeting with it. In general, after passing a few yards through marl, the wells terminate in a layer of coarse sand. On the western border of the pampa are several wells which have been sunk through trachyte, and brackish water obtained at a depth of from twenty to thirty-five feet. In the neighborhood of Almonte, during my visit to that place, workmen were engaged in sinking a well, and had then attained the depth of one hundred and fifty feet without meeting with water. This well passed fifty feet through marl and clay, two feet through coarse sand, eighty feet through clay, ten feet through fine gravel, and terminated in a bed of coarse gravel and pebbles, mixed with large water-worn stones.

In the vicinity of Pica are two hot springs, one of which is 92° and the other 98° Fah. The water contains a small portion of carbonate of soda.

Among the hills which skirt the coast, and at their base on the western side of the pampa, are beds of *nitrate of soda*, which cover a tract of country not less than one hundred and fifty miles in extent. They are slightly elevated above the level of the plain, and covered by a light, dry, sandy marl, mixed with minute fragments of shells. This covering yields with a crackling noise to the pressure of the feet while walking over it, and thus affords an indication of the presence of nitrate of soda beneath, and is a common guide for those who are in search of it. Below this, and but a few inches from the surface, there is usually a layer of common salt, about a foot thick, possessing a coarse fibrous structure. Under this lies the nitrate of soda, resting on marl impregnated with saline matter and mixed with fragments of shells.

This salt, technically termed *caliche*, varies in the quantity or nitrate of soda which it affords, from twenty to seventy five per cent. With it there is generally more or less insoluble matter, consisting of red marl and fragments of shells, in some beds amounting to nine per cent., but averaging not more than three per cent. It possesses a granular structure, arising from irregular rhombic crystals, which vary considerably in size in different localities. Some of the beds are exceedingly compact, and when wrought, require to be blasted with gunpowder; while others are easily broken with the aid of a pick and shovel. Cavities are occasionally found partly filled with crystals, regular in form and nearly pure. The color varies in different beds, and in different parts of the same bed. Some specimens possess the whiteness of refined loaf sugar; others are reddish brown, lemon yellow, and gray. Every variety is found in the same bed, but the compact white and yellow is most abundant between the quebrada of Tiliviche and the point called Molina. The composition of average specimens from the beds which are worked, as determined by Mr. A. A. Hayes, is as follows:

Nitrate of soda,	64.98
Sulphate of soda,	8.00.
Chloride of sodium,	28.69
Iodic salts,	0.63
Shells and Marl,	2.60
	99.90

We are indebted to the same gentleman for our knowledge of the presence of *iodate of soda* and chloro-iodate of magnesia in combination with this salt.*

* The "mother" water, at some of the refineries on the pampa, are very rich in iodic salts; their presence was first observed by noticing the deep blue color produced by some crumbs of bread which had accidentally fallen into the vats.

In various parts of the western coast of South America, between 18° and 23° of south latitude, nitrate of soda is found impregnating the soil in connection with other saline matter, and in some instances forming a thin crust on the surface; but no where in extensive beds as in the province of Tarapaca, between 19° 30′ and 20° 45′ south latitude, and 69° 50′ and 70° 5′ west longitude, although it has been frequently mentioned by travellers as abundant in other parts of the coast. This error has probably arisen from the general use of the term *sallitre*, which is applied alike to saltpetre and other salts.

The nitrate of soda of Tarapaca affords employment for a large part of the inhabitants of the province. In 1837 one hundred and fifty thousand quintals were shipped from the port of Iquique; of this, about two thirds went to England, and nearly one third to France. Its recent introduction as a manure will probably greatly increase the demand for it in foreign countries.

The process of refining, through which the crude salt passes before it is transported to the ports for exportation, is rude and simple. The operation is conducted generally by Indians, under the direction of a Spanish major-domo. Each *officina* or working place, consists of a few rude huts, the walls of which are constructed of cakes of salt, cemented together with the mixed marl and salt obtained from the kettles in use for refining, the roofs being formed of mats, supported by rafters of cactus.

All the work of refining is conducted in the open air. The apparatus consists of a few copper kettles, of the capacity of fifty gallons each, set within walls formed of cakes of salt, and shallow oblong square vats for crystallizing. The salt, as blasted from the bed, which is always near to the officina, is carried in bags on the backs of laborers near to the kettles, where women and children are employed in breaking it into fragments of the size of hens' eggs. About two thirds of each kettle being filled with the broken salt, and water added, a strong fire is maintained until the water becomes saturated, when it is dipped into tubs to settle, and from thence transferred while hot to the crystallizers. The undissolved portion which remains, consisting principally of chloride of sodium and earthy matter, is thrown aside as worthless, although frequently not more than one half of the nitrate has been separated, the same relative proportion of crude salt being at all times used, without regard to its quality.

Aside from the want of economy displayed in the refining process, the affairs of the officinas are well conducted. Each branch of the operation, from the breaking the salt from the bed up to the time when it is placed on board vessels for exportation, is conducted by a distinct class of laborers, who receive for their work a fixed sum on each quintal of the refined salt produced. The cost to the refiner for labor, for each one hundred and two pounds, is about five reals, or 62½ cents; for fuel, from two and

a half to three reals; for powder and tools, about one real; and for transportation to the port, from five to six reals; making in all $1 87½, which is probably something more than the average cost of nitrate of soda, exclusive of bags for packing, and the expense of constructing, keeping in repair, and superintending the establishment.

Ores of silver, antimony, and copper, are found in the porphyritic hills on the coast—the two former near Iquique, in extensive veins, the latter in inconsiderable quantity near Pisagua and in the vicinity of Tanna. Copper also occurs at the extreme southern and eastern part of the province, in veins traversing feldspar. The ores are sulphurets, carbonates, and muriate. In the same range of hills, a little further south, and without the limits of the province of Tarapaca, this latter ore has been found in such quantity as to give rise to extensive workings. It is procured by the Indians, and sold, under the name of *arenilla*, as sand for letter writing.

ART. 7.—IRON TRADE OF SWEDEN AND NORWAY.—By H. SCRIVENOR.

SWEDEN has been long celebrated for its mines and mineral productions, particularly iron, which still forms one of the principal exports, although it has much decreased of late years. By an account taken by the government in the year 1748, we find that, at that time, there were 496 foundries, with 539 large hammers, and 971 small ones, for making bar and other manufactures of iron, which produced 304,415 ship-pounds*, or nearly 40,600 tons.

The government established an office in 1740 to promote the production of iron, by lending money on the ore, even at so low a rate as 4 per cent.; a correct register was then made of the mines, which is still continued. Each forge has its particular mark stamped on the bars of iron it produces, which is correctly copied into the manuscript, with the name of the place where the establishment is situated—the names of the proprietors of the work—the commissioner or agent for the sale of the iron—the assortment each makes, and to what country it is generally shipped—the quantity annually made by each work—the quantity which each work delivers to the government (which is about 1 per cent. on the quantity of the iron produced)—the estimation of the quality of the iron of each work, which is variable—the place and province in which the works are situated—the place from whence the iron is generally shipped, and how many hammers each work has: all which particulars are regularly and alphabetically described and arranged.

* 7½ to a ton.

As the working of the mines is attended with considerable expense, and the sale of the iron uncertain, the Bank of Stockholm receives that metal as a proper security for a loan. The iron being duly appraised, and lodged in the public warehouse, the proprietor receives three fourths of its value, at the interest of 3 per cent., and when he can find an opportunity to dispose of his iron, it is again delivered to him, on producing a certificate from the bank, that the loan upon it is duly discharged.

The iron mine of Dannemora, the most celebrated in Sweden, is situated in the province of Upland, about one English mile from Osterby, and thirty English miles north of Upsala. This mine was discovered in the year 1448, and though it has now been wrought for four centuries, it still yields abundance of the best iron in Europe.

The iron mine is on a hill so little elevated above the surface of the neighboring country as easily to escape observation. It is about two English miles long, and nearly half a mile broad; it is almost surrounded by lakes—those of Dannemora, Films, and Grufve, lying quite contiguous to it. On the side where there are no lakes there is a turf moss. The ore forms a large vein in this hill, which stretches in a north-west and south-east direction. The mine was some years ago inundated by the water from the adjacent lakes; a strong wall, however, has been built to keep off the water. It is drained by two steam-engines, kept at work by means of wood for fuel.

It was first wrought as a silver mine, the silver being extracted from galena. This source of emolument soon failing, or becoming unproductive, the iron ore began to be extracted and smelted, and the excellent quality of the iron gradually drew to it the attention of the public. At first it belonged to the King of Sweden, but that monarch consigned it over to the Archbishop of Upsala as a part of his revenues; at present it belongs to a number of private individuals, who work it separately, each on his own account.

At the side of the mine is a large opening, about fifty fathoms deep and fifty wide, and at the lower part of this is the entrance to the mine, which is wrought about thirty fathoms deeper than this opening. The mines are thus described in "Coxe's Travels," who visited them in the year 1790:—"The pits are deep excavations, like gravel pits, and form so many abysses or gulfs. The descent is not, therefore, as is usual in mines, down a narrow subterraneous shaft. At the side of the mine I stepped into a bucket, and, being suspended in the open air, in the same manner as if a person was placed in a bucket at the top of Salisbury spire, was gradually let down to the ground by a rope and pulley. The inspector accompanied me to the bottom, and while I was placed at my ease in the inside upon a chair, he seated himself on the rim of the bucket, with his legs extended to maintain the

equilibrium. He had in his hand a stick, with which he gently touched the sides of the rock, and the rope of the ascending bucket, in order to prevent our bucket from swerving against them, which must have infallibly overset us.

"While hung suspended in mid-air, and so giddy that I could not venture to look down, I observed three girls standing on the edge of the ascending bucket knitting, with as much unconcern as if they had been on *terra firma;* such is the effect of custom. We were about five minutes in descending, and the depth which we reached before I stepped out of my aërial seat was 500 feet. Not being a mineralogist, my curiosity was soon satisfied; I again got into the bucket, and was drawn up in the same manner.

"The inspector informed me that the richest ore yields 70 per cent. of iron, the poorest 30; that, upon an average, the collective mass gives one third of pure mineral; that about 12,000 tons are annually drawn from the mines, which yield about 4000 tons of bar-iron.

"The mass of ore occupies a small compass. The length of the pits, considered as one, is 760 feet, and the breadth from three to twelve. The ore runs from east to west. The richest ore is near 500 feet in depth, and the Storoe Grube is not yet fathomed.

"The matrix of the ore being a calcareous earth, consequently contains but little sulphur, which is, perhaps, the reason of its superior quality."

The ore is blasted with gunpowder. The part of the vein which lies under the great opening, which forms the mouth of the mine, is called *stor rymning;* it constitutes by far the greatest portion of the mine. The next portion is called *jord grufva* (earth mine), and it yields the ore of the very best quality. The portion farthest south is called *sodra grufva*, or southern mine; it yields the worst kind of ore of all the three, probably from being mixed with galena and blende. The rock through which the vein runs is said to be quartz. The substance immediately contiguous to the vein appeared to Dr. Thomson to be hornstone, and to contain hornblende. The ore itself contains limestone, quartz, and actinolite, and affords from 25 to 75 per cent. of cast-iron. In the worst kind of ore Dr. Thomson also perceived blende, fluor-spar, galena, and amethyst, but in small quantities. Carbonate of lime, crystallized in dodecahedrons, also occurs in this vein; and likewise sulphate of barytes, mountain cork, and the aplome of Haüy.

The ore is broken into small pieces, and roasted; it is then put into conical shaped furnaces, constructed of the slag from cast-iron. In these furnaces it is mixed with the proper quantity of charcoal, and then melted and separated from the slag. The cast-iron obtained in this manner is as white as silver, completely crystallized, and very brittle. The cast-iron is reduced to mallea-

ble iron by heating it in a bed of charcoal, and hammering it out into bars. In this state it is whiter than common iron, and is less liable to rust, is distinctly fibrous in its texture, and much stouter than any other iron.

The cause of the superiority of the Dannemora iron has never been explained. Some chemists ascribe it to the presence of manganese. Berzelius attributed it to the presence of the metal of silica, while others suppose it to arise from the nature of the process employed. Dr. Thomson was assured by one gentleman, who had bestowed particular attention to the subject, that by following a similar process he has obtained as good iron from other Swedish ores. But that something is due to the ore itself is evident from the circumstance, that the quality of the iron, though the same process is followed, differs a good deal, according to the part of the vein from which the ore is taken.

In the neighborhood of the mines are establishments for forging the iron, and for the accommodation of more than 800 workmen and their families. Each of the little villages has three or four regular streets, often planted with trees, a church, a school, and a hospital.

In 1833 there were in the whole of Sweden from 330 to 340 smelting furnaces, producing 90,000 to 95,000 tons of pig-iron; in converting this into bar-iron, about 28 per cent. is allowed for waste, and as near as can be ascertained the annual manufacture of this latter is 63,000 to 65,000 tons. The number of iron works is about 420 to 430, having about 1100 forge-hammers. The annual export of bar-iron on an average of ten years, ending 1831, was 49,568 tons. The smelting furnaces and iron works are licensed for a particular quantity, some being as low as 50 tons, others as high as 400 to 500 tons per annum; some few bar-iron works draw licenses for 1000 tons each. The licenses are granted by the College of Mines, which has a control over all iron works and mining operations. The iron-masters make annual returns of their manufacture, which must not exceed their privilege, on pain of the overplus being confiscated, and the college has subordinate courts, called courts of mines, in every district, with supervising officers of various ranks; and no iron can be sent to any port of shipment without being landed at the public weigh-house, the superintendent of which is also a delegate of the college, and his duty is to register all that arrives, and to send his report quarterly to the college. It is impossible for an iron-master to send to market more than his license. Many, however, sell at the forges to inland consumers, returns of which are never made, and so far licenses are exceeded, but it is supposed this excess cannot be above 3000 tons.

There is no chance whatever of the manufacture of iron in Sweden becoming free; on the contrary, there is much greater probability of its decrease, as in those parts of the country where

iron works are established there are already as many forges as the neighboring forests can supply with charcoal. If there are proprietors of forests on which they can prove that iron works have not been privileged in former times, in that case the Government cannot refuse to grant the right of erecting works in proportion thereto; but, except either very far north, or far in the interior, there do not exist such woods.

It does not always follow that the forests belong to the proprietors of the iron works, but they have, nevertheless, the right of purchasing all the charcoal sold from these woods. We may consider the case in this manner:—A person, a century back, who had 20,000 acres of forest, may have obtained the privilege of manufacturing 200 tons of iron annually; the estate in the lapse of time has become divided amongst a number of heirs, or has been sold in lots to different persons; but the proprietor of the iron works still retains the right to the charcoal of the whole, if any is made for sale.

There is no department in Sweden conducted with more fairness than the College of Mines, which manages these matters.*

	Average Produce.		Average Exports.
Years.	Unwrought Iron. Tons.	Bar-Iron. Tons.	Bar-Iron. Tons.
1833 to 1839 . .	89,610	73,592	58,766
1840 — 1844 .	105,485	84,041	66,046
1845 — 1849 . .	106,630	90,466	74,069
1850 — 1852 .	124,169	99,889	75,940

Important recent discoveries have had, and necessarily will have, a material effect on the iron manufacture of Sweden. Dr. Ure may introduce the subject to our readers in the following observations respecting Mr. Heath's experiments in the manufacture of *steel* and their results:—

"One of the greatest improvements which this valuable modification of iron has ever received is due to Mr. Josiah M. Heath, who, after many elaborate and costly researches upon both the small and the great scale, discovered that, by the introduction of a small portion (1 per cent., and even less) of carburet of manganese into the melting-pot, along with the usual broken bars of blistered steel, a cast-steel was obtained after fusion, of a quality very superior to what the bar-steel would have yielded without the manganese, and moreover possessed of the new and peculiar property of being weldable, either to itself or to wrought iron.

"He also found that a common bar-steel made from an inferior mark or quality of Swedish or Russian iron, would, when so

* In several parts of Lapland, the protoxide of iron occurs in great beds, or immense masses; at Gillivara, 200 leagues north of Stockholm, towards the 67th degree of latitude, it constitutes a considerable mountain. The iron is despatched in small sledges drawn by reindeer, to streams which fall into the Lutea, and thence, by water carriage, to the port of Lutea, where it is embarked for Stockholm.

treated, produce an excellent cast-steel. One immediate consequence of this discovery has been the reduction of the price of good steel in the Sheffield market by from 30 to 40 per cent., and likewise the manufacture of table-knives of cast-steel with iron tangs welded to them; whereas, till Mr. Heath's invention, table-knives were necessarily made of shear-steel, with unseemly wavy lines in them, because cast-steel could not be welded to the tangs."

Mr. Heath obtained a patent for this and other kindred meritorious inventions on the 5th April, 1839, "but, strange and melancholy to say," observes Dr. Ure, "he has never derived anything from his acknowledged improvement but vexation and loss, in consquence of a numerous body of Sheffield steel manufacturers having banded together to pirate his patent, and to baffle him in our complex law courts." Whether the remarks on the conduct of the steel manufacturers of Sheffield are just, is not important to this inquiry; the fact is, that various alterations and improvements have been effected in the manufacture, not confining it to the use of Swedish or Russian inferior marks, but to the use of English iron, and this to the extent of attracting the notice of Mr. C. F. Wœrn, Junior, a member of the Swedish Diet, who made it the subject of a motion in the Diet, 1853-1854: —"On the repeal of the taxes on pig and bar iron, as well as of the privileges still existing in favor of the mining districts and iron works of Sweden."

Mr. Wœrn, in his Treatise—after a review of the iron trade in Sweden during the last twenty years, and arriving at the conclusion that the home consumption has certainly been on the increase, owing to the general growth of population and trade between the years 1834 and 1851—says: "Yet, in comparison to the population, the consumption per man is very much smaller than in other civilized countries; accurate calculations on this subject show the following results—all kinds of iron being reduced into pig-iron:—

In North America the consumption is	88 lbs.	per head.
Great Britain	81	"
France	36	"
Hanover and Oldenburg	29	"
German Customs' Union	24	"
Switzerland	18	"
Sweden	11½	"
Austria	11	"
Russia	8	"

At present there is reason to believe that the Swedish consumption is 14lbs. per head.

He then speaks of the exports of bar and manufactured iron from Sweden, which, during the same period, he calculates to have increased about 25 per cent.

In order to show the insignificance of this increase, in com-

parison to that which has taken place in other countries, he reviews the trade, and speaks more particularly of the discoveries and improvements made from 1796 to 1851 in Scotland, and observes: "Instead of having been, as before these discoveries and improvements were made, only two fifths of the Swedish production, it rose in Scotland in ten years to double the Swedish production, and is now six times as large. In Wales we notice the same thing, as well as in the United States, Belgium, Silesia, the German provinces on the Rhine, and even France. If we compare the countries which chiefly produce iron for the last twenty years, we find that

Great Britain	increased in	1850	244	per cent.
United States	"	"	471	"
France	"	1846*	141	"
Russia	"	1849—1851	20	"
German Customs' Union	"	1850	60	"
Austria	"	"	130	"
Belgium	"	"	217	"
Sweden	"	"	51	"
Norway	"	1841—1845	62	"

and thus the production has increased more rapidly in every country than in Sweden, with the single exception of Russia. Now, if we compare the total production of these countries twenty years ago, and that of Sweden at the same time, with what it is now, we find that the production of this country has suffered a decrease from $\frac{1}{16}$ to $\frac{1}{33}$."

He then goes on to the more important subject of the manufacture of English steel. He says: "I have found it impossible to obtain trustworthy information as to the amount of manufacture or consumption of English steel-iron; but to a certain extent such a guide is found in the number of steel furnaces in Sheffield and the neighborhood. I have had returns made at four different periods. The first, of 1835, is found in Porter's 'Progress of the Nation;' the second, of 1842, is given by Professor Le Play, in his excellent treatise on the manufacture of steel in Yorkshire; the third is of the year 1846, and is part of the evidence of one of the largest manufacturers of Sheffield, Mr. Henry Unwin, before a Committee of the House of Commons, on the occasion of a railway being applied for to Sheffield; and the fourth is the result of an account taken at my request by the same gentleman, in July this year, of existing furnaces, in which he says he is so much the more sure of not having overstated the case, as he has separately noted the owner and situation of each furnace.

"According to these statements, there existed, in Sheffield and the immediate neighborhood, in

* Mr. Wœrn states the make of pig-iron in France, in 1846, as 2,742,51 shiplbs. T. v., equal to 457,087 tons.

1835,	56	blistered-steel furnaces, and	554	cast-steel furnaces,
1842,	97	"	774	"
1846,	105	"	974	"
1853,	160	"	1,495	"

"The new furnaces are built rather larger than the old ones, and Mr. Unwin estimates their capacity of production at 300 tons annually, and the total production of steel in England at 40,000 tons.

"Porter estimates the manufacture of steel in Sheffield in 1885 at 15,000 tons, of which 2,000 tons were from English iron. The same amount is given by Mr. Danielson, in his Treatise on the Manufacture of steel in England in 1844. Mr. G. Ekman, in his letter which refers to Professor Le Play's work, estimates this production of 1845 at 3,000 tons; and, according to Mr. Unwin's statement, giving 40,000 tons as the annual production of steel in England, it must now amount to 7,200 tons, when the whole import of foreign iron not re-exported has been deducted. *The English steel-iron is moreover universally known for its closeness and pureness, and some of the best sorts are so much liked, that they fetch a higher price than the best Swedish marks.*"

Thus much as to the competition of British iron with Swedish, in Great Britain, for the manufacture of steel. He then refers to the export to other countries, and shows that of Great Britain to be five or six times as large as it was, whilst that of Sweden has been almost stationary,—"that the latter amounted to almost one half of the export of Great Britain twenty years ago, and in 1850 it was scarcely a tenth part of it, and must since then have fallen off still more."

The object of Mr. Wœrn's motion was to alleviate, if possible, this state of affairs, by inducing the Government to remove all taxes and restrictions on the manufacture of iron. But the greatest difficulty Sweden has to contend against, as far as the increase of manufacture is concerned, is *the want of coal.*

Now comes a consideration, whether, with the immense abundance of rich ore which Sweden possesses, there are not certain localities where it may be shipped at a low rate of cost. Let the Swedish Government take off any heavy restrictions on the export of this ore, and a valuable trade may be encouraged between Gottenberg, or other shipping ports, and the port of Newcastle, thus bringing the ore to the coal, and a more certain benefit might be derived by Sweden than by an attempt at any great increase of the manufacture.

Oddy, in his work on "European Commerce," observes, that iron makes no regular article of export from Norway; yet there does not appear any reason why they might not have cultivated this branch of manufacture as well as Sweden. Wood they have in sufficient abundance. There are several foundries in Norway, but they have not been worked with spirit; their produce is

therefore but small. Since the year 1792 they have not much extended their works. Moss, a town of a thousand inhabitants, contains a principal iron work. Skaggerak is also in repute for its iron trade.

The iron mines of Norway lie on the coasts of the Gulf of Christiania, and on the side facing Jutland, principally at Arendal, at Krageroe, and the neighborhood. The ores consist almost solely of black oxide of iron, which forms beds in veins of from 4 to 60 feet thick, incased in gneiss. These iron ores are reduced in a great many smelting forges situated on the same coast, and particularly in the county of Laurwig. The annual product is about 7,300 tons, in the form of cast-iron, bar-iron, sheet-iron, nails, &c., of which one half is exported.

AVERAGE MAKE OF BAR-IRON.

Years.	Tons.
1831 to 1835	3,645
1836 — 1840	3,898
1841 — 1845	3,772

Average export, about 2,050 tons.

ART. 8.—THE COAL LANDS OF THE CLINTON COUNTY COAL COMPANY OF PENNSYLVANIA.

HAVING made a geological investigation of a tract of coal land near Farrandsville, Clinton Co., Pa., I would state the following interesting particulars:—

This tract comprises so extensive an area, and is so varied in its general features, that to be enabled the better to judge of its character and to appreciate its qualifications, it will be found necessary to make some general examination of the surrounding country to serve as a standard of comparison.

There is a stream which passes the Farrandsville Mines, and empties into the Susquehanna; near the mouth of this stream a bridge crosses it, and at the abutment of this bridge, on the water level, is the point from which all elevations in this report will be taken.

The first point of observation was at Queen's Run, about two miles below Farrandsville. The barometer here gave an elevation of 652.1 English feet, at the floor of the upper vein.

At this location the whole country appears to have been materially changed, and the stratification greatly contorted, and broken through by the upheaval of the Alleghany Mountains, or the subsidence of the coal-bearing strata.

There are three well defined strata of coal in this section of the State, and each of the three are found upon this mountain.

The first, or "Hepburn Vein," is the lowest of the three

veins, being about ninety feet below the upper vein, and is about four feet thick: the reef, or rock immediately covering the coal vein, is a light black argillaceous or clay slate, and the floor, or rock upon which the coal vein reposes, is composed of a slate of a deep black color.

The second, or middle vein, is called the "Rolling" or "Spearing" vein, and will average about three feet in thickness. The roof is of a coarse-grained sandstone, a silicious grit, interspersed with small black spots, and marks, the remains of vegetable matter, in some cases simply charred, and in others converted into coal. The floor is a black fossiliferous slaty shale, impregnated with particles of a silicious nature. The roof of this vein holds an undulating position, sometimes crowding the coal out to a narrow seam, at others widening to the full average thickness of the vein; the floor seldom shows a corresponding depression or elevation. It is from the wave-like position of the roof that the vein derives the name of "Rolling," that of "Spearing" being the individual appellation of its discoverer.

The third, or upper vein, is called "Queen's Run Vein," its average thickness is about four and a half feet. The roof is a clay slate formation, of a light ash brown color, the seams of which are coated with a thin film of red and yellow oxide of iron; the floor is a clay bed several feet in thickness, and valuable as an article from which a superior quality of fire-brick is made. The coal in this vein is of a bright shining fracture, and of a superior quality.

I have been thus particular in the description of these veins, as with a few unimportant local exceptions they are uniformly regular. From the uniform and consistent position of each of them; from the same characteristics attending each in whatever place it may be found,—such as its average thickness, plane of dip, roof rock, and flooring,—it would appear that the entire deposit of the vegetable matter of each strata was formed in a different epoch, but in the same basin; and that the position of the beds as now found, with mountains, hills, valleys and ravines separating them from each other, is the result of combined upheaval and depression,—upheaval or elevation so gra dualand quiet, as to disturb but slightly the stratification, and that only where in immediate contact with the operation of the motive forces; and depression or subsidence so moderate and gentle as not to displace the layers of mineral matter except when in close vicinity to the moving mass. This principle being established, it would show that those portions which are least disturbed by geological causes, are the most advantageous positions at which to make the most profitable operations for coal, both as to quantity and quality.

At this mine the coal sells readily at the vein bank at two dollars per ton, and if shipped to Philadelphia will net one

dollar and ninety cents per ton, or ten cents less than if sold at the vein. It costs 70 cents per ton to mine the fire-clay at this mine. The demand for fire-brick this present season is far greater than the supply, owing to the re-working of so many of the iron works.

The second point of observation was at the Farrandsville Mines. At this point I took a series of barometrical observations, the mean of which gave an altitude of 470.9 English feet. This mountain lies far below the general average level of the coal-bearing strata, and is somewhat of an anomaly in the coal measures. This fact proves that elevation only is not a reliable criterion upon which to base coal locations.

At this mine, the Queen's Run Vein carries more slate than is usual in other localities in the coal measures, though its accompanying mineralogical features are, as elsewhere, well defined. There is found on this mountain an ample supply of a beautiful yellow sandstone, easily worked, durable and well adapted for building purposes. A large iron furnace, and the buildings usually connected with such an establishment, have been erected at this place, of this stone, and having stood the test of several years, appear as fresh, and free from the action of the atmosphere, as when first constructed.

The third point of observation was upon a mountain ten miles above Farrandsville, upon the same side of the river, and about one mile from Grogan's.

The elevation at this point was 865 feet. A coal vein has been opened here, simply to prove its place, but has never been worked, nor sufficiently opened to determine its character or quality. It is an interesting point as showing a far higher elevation than the Queen's Run or Farrandsville Mines, and from the outcrop of mineral evidences, would naturally lead to the expectation of finding other veins below the one already proved.

These three positions being prominent points in the country adjoining the lands to be examined, formed a necessary part of the preliminary investigation, and establish the facts of the general features of the coal veins, their attendant rocks, average thickness, and variation of altitude. To fully understand this tract, to comprehend its general features, to be enabled to appreciate it as a whole, it is necessary to advert to these seemingly isolated facts and positions, that when brought into juxtaposition and blended into unity, they may, like the builder's materials when properly placed, serve to construct an edifice of positive utility.

Upon Rainbow Mountain, directly upon the opposite side of the river to the last place examined, the first exploration was made. Here we reached an altitude of twelve hundred and ninety feet (1,290) by barometrical measurement, passing over a mountain elevation, unbroken in strata, and with a surface varied

only by valleys of denudation, and covered with a heavy growth of timber, consisting of pine, hemlock, oak, &c., &c. There is here an area of some 600 acres, which has in no place been proved, but the external evidences of coal are amply sufficient to induce the belief of extensive beds being opened upon a thorough examination.

Nodules of "white iron ore" are found upon its surface, and would lead to the conclusion that working beds of this valuable material may be found, should the mountain ever be worked for coal.

Judging from the geological indications which are in all parts of this mountain so fully scattered over its surface that coal will be found here, I would recommend, at a suitable time, a full investigation to prove the presence of the veins, not doubting but that satisfactory discoveries will reward the exploration. Its proximity to the line of the Sunbury and Erie Railroad, will make it a desirable point upon which to find a coal deposit.

The second exploration was made upon the mountain on the south side of the Susquehanna, and west of the Taugascootac River. By a series of observations it appears that the mountain attains an elevation of eleven hundred and sixty feet upon the summit; at the upper vein or drift it is ten hundred and eighty-nine feet.

From the altitude above the conglomerate, which appears near the "Red Horse Tavern," and which is three hundred and fifty-three feet, it scarcely appears possible that the upper vein can be the "Queen's Run Vein," as the utmost elevation this vein has ever attained is about ninety feet above the Hepburn Vein. By a reference to the characteristic rocks of the roof and floor of the Queen's Run Vein, before alluded to, it appears that they are formed of a clay slate and a variety of the same rock called fire-clay. The roof of this upper vein is of a reddish-white sandstone formation, and the floor a dark sandstone impregnated with iron, so that the character of the Queen's Run is here found wanting. I should incline to the opinion that this is the "Snow Shoe" vein, which, should it so prove to be, will give this tract five veins of coal instead of only three veins. This fact can be determined only by further exploration.* Upon Johnson and Little's tract the coal field has been proved by driving an adit to the extent of between seventy and eighty yards; by which means the thickness, regularity and quality of the vein have been fully ascertained.

* Subsequent examinations, made during the summer of 1854, by other persons, have conclusively proven the above opinion. Five veins are now known to exist, and the evidence is strongly favorable to the belief of a sixth vein holding a position at this location. The upper vein has been tested, and evinces a very good gas coal at the outcrop, which must necessarily improve in quality as the work is carried to a greater depth upon it.

Should this prove to be the "Snow Shoe" vein, the immense body of coal in the tract beneath it, would almost defy calculation, and tire the mind to follow the long retinue of figures to denote its number. Should it be the Queen's Run, still the amount in its own bed, and the vast amount in the two beds beneath it, would render the supply such as could not in a long series of years be exhausted.

The character of the coal in this upper vein is of the highest order, clear, shining, free from sulphur and clear of slate. It can be mined and loaded at about four tons per day to each man. The floor of the vein is impregnated with iron ore, and should it be found in sufficient quantity to warrant working, it can be removed after each gallery is cleared of coal, by taking up the floor, removing the iron, and leaving the rubbish in the useless space. Even the pillars of coal might be removed from these parts of the mine, the props be taken away to use elsewhere, and that portion of the roof allowed to fall in. By this course the entire coal, with the iron ore, could be worked out, and even the props be made useful a second time.

A shaft was opened to prove the vein, some four or five hundred yards distant from the drift, and the quality of the coal, the thickness of the vein, the general appearance of the strata, were all the same as at the drift, placing the bearing of the field beyond a doubt.

The second vein which was proved, near the "Bear Wallow," shows a sandstone roof, slate floor with eleven (11) inches of coal next to roof, reposing on two and a half feet of superior quality of fire-clay, covering three and a half feet of coal. This formation does not correspond with the Rolling vein, and is, I think, additional proof that the upper vein here is not the Queen's Run vein. The upper stratum of coal of 11 inches in this vein is said to be a good gas coal. The fire-clay at Queen's Run costs 70 cents per ton to mine, while at this vein it could be mined at a trifling expense while removing the coal.

The distance between this and the upper vein is 44 feet, while the distance between the Rolling and Queen's Run is only about 18 or 20 feet, which is a still further proof.

The coal also is of a very superior quality, and as no fault, ravine or draught exists between this point and the drift, it must not only underlie the same extent of field, but also all the intermediate space, and a corresponding radius upon all sides of the upper field.

The "Bear Wallow" is *not* the limit of this branch; it extends over a mile in distance further, in a direct line, from the drift, covering perhaps one thousand acres, or more. Professor Rogers, in his State Report of February 8, 1840, page 158, speaking of this very tract, says:—"This basin is prolonged, no doubt, across the head streams of Beach Creek, and embraces the coal measures at Snow Shoe and Phillipsburg."

I would recommend a series of judicious openings at various points upon this mountain, taking the bench lines as a guide, and thus determine, as nearly as can be ascertained, the certain extent of each vein. This plan, carefully attended to, would occupy a series of some months' work, but the whole might be planned out in a series of observations extending over some few weeks, and the labor be subsequently executed according to the plan, as rapidly as circumstances would permit. It would be advantageous to the general interest of the company to have this done before the final completion of the railroad, as such provings or openings would indicate the most feasible points at which to operate upon the coal beds, and, perchance, have no small bearing upont he terminus of the road, or some, if not all, of its branches.

The almost perfect horizontal position of these beds shows them to have been free from the disturbing influence of many portions of the coal district, and also presents conclusive evidence of their proximity to the central portion of the great coal basin; a position well calculated to render them productive of a superior quality of coal, free from foreign and extraneous matter, and unaltered by chemical or natural changes. The fact of the rich, clear, brilliant, sparkling fracture of coal from this vein is proof of the validity of this statement; and should the fact of these two veins being above the Queen's Run become indisputably established, it would present additional evidence of the perfect repose which has never been disturbed since the formation of this portion of the coal measures.

Inferring from the geological indications which are in all parts of this section so uniformly evidence of extensive coal deposits; taking that peculiar silicious formation, a sandstone of such individual features that it cannot be mistaken; together with the clay slates of various shades of color, and distinctive marks of identity; and the fossils of that class that ever appertain to the coal formation, the geologist cannot but yield to the unmistakable testimony, which is at every step obtruded upon his view, and submit to the conviction, that coal depositions greater than have even been estimated, are buried for the present beneath these mountain surfaces. The formation of the rocks, their mineralogical structure, their fossiliferous products, being such as ever accompany the coal beds, are characters—to point to the location of these resources so necessary to the comfort and social advancement of the human race—written by the hand of Omniscience too indelibly to be effaced, too legibly to be unread, and impressed with the uniform truthfulness and veracity of Deity.

The same yellow sandstone so suitable for a building material, which I mentioned as being abundant at Farrandsville Mines, is equally so upon this section, accompanied by a white fine-

grained sandstone, admirably adapted to the manufacture of glass, and equally ample in quantity.

I find that these various points are most of them well stocked with a good growth of timber, consisting of pine, oak, hemlock, &c. &c., suitable for market, easily accessible, and of no small value. Much of the summit land upon the tables or level tops of the mountains, is of a superior quality for agricultural purposes; and in the opinion of many farmers of intelligence and experience, would produce abundant crops of wheat, corn, potatoes, &c.; and should the passes of these mountain districts ever be rendered easy of being travelled over, there can be no doubt but that these lands will be eagerly sought after and occupied by agriculturists, not only for their productive qualities, but also for their salubrity. Their elevated position, pure air, good water, and naturally rich soil, will cause them to be desirable locations for the tillers of the earth.

If men of families can be employed upon the works, I would suggest the policy of selling to them some fifty acres each, upon condition that they should cultivate the same, reserving, of course, all mineral right, and allowing the payment to be made by a monthly deduction from their wages.

This plan, with perhaps some modifications, would retain in employment steady, honest and sober men; and awaken among those thus settled a feeling of interest in the prosperity of the mines which would be ultimately of the utmost advantage to the company. More labor will be done by a cheerful, interested man, than by one uninterested and having no inducement beyond his daily stipend to urge him to exertion. As an additional incentive to full labor, a moderate bonus might be given to the man producing the greatest quantity of coal, during the month, this bonus to be applied to the payment of the land; thus making him feel that every stroke of the pick, was elevating him to a position of a free landholder; while the balance sheet of the company would manifest in figures, the additional profit certain to arise from such a plan.

The surveyed route of the railroad from the drift to the vein, commences on the south side of the Susquehanna, about one mile below the mouth of the Taugascootac, which latter stream it crosses, and then follows for about four miles upon a natural grade formed by a valley of denudation caused by the course of the creek. The very position of this natural grade would exemplify the perfect repose of this part of the coal basin, to which I have previously adverted. This route is continued until within about five miles of the drift, over which latter portion the grade will be heavier, still not sufficiently so to prevent the construction of an easily traversed road. Leaving the mines, the distance will be about five miles over the heavier grade, then four miles over the natural grade, and terminating upon a level

of several acres, upon the Susquehanna shore, making the entire length nine miles, which can be passed over with the utmost ease by a loaded train in thirty minutes. About 50 or 60 feet from the shore a small island is formed, the channel between which and the shore is at the present low stage of the river about ten or twelve feet deep; capable of accommodating three or four boats side by side, and loading them direct from the cars, with coal loaded at the mines.

There is also a large portion of the upper lands which from my limited time I was unable to examine at this visit; in fact to do ample justice to the portion of the lands I have hastily examined, would require a much longer period than I have bestowed upon them.

Should this tract ultimately prove to contain the Snow Shoe Vein, then the four veins which must of necessity underlie it, will give an area of over two thousand acres to the coal field on this one portion of the tract alone.

In my opinion the remainder of the tract will cover about seven thousand acres of coal-bearing fields; the exact position and quantity of each will have to be determined by future exploration.

S. P. L.

JOURNAL OF MINING LAWS AND REGULATIONS.

THE MINING CODE OF VENEZUELA.

Of the acts that must precede the application asking for the grant of a mine.

Article 1. No person can introduce sounds or borers on a ground that does not belong to him, without the express permission of the owner of the ground, or with the permission of the government given after having heard said owner, with the object of obtaining his consent in consequence of a previous arrangement made with him. If the ground should belong to the nation, no permission shall be needed to make all the investigations deemed necessary for the discovery of a mine.

Article 2. No permission for investigating, or grant for mining, can give the right of sounding and digging or opening galleries, nor establishing machinery or storehouses in inclosed spots, nor on grounds contiguous to habitations, without the formal consent of the owner of the grounds.

Article 3. The owner of the ground can make investigations without previous requisites on the spots exempted by the foregoing article, as also on the other parts of his property; but he is bound to ask for a permission of the executive before establishing on those grounds the working of the mines. In no case can the investigations be permitted on a ground previously granted.

Article 4. Any Venezuelan or naturalized foreigner has the right of asking for a grant for mining if grantable.

Article 5. When the workings are to be made in houses or habitable places, or that the workings are to be carried out in places where other contiguous working is going on, the petitioner must give security for paying whatever indemnification in case of any accident. In such case the applications or oppositions of the persons concerned shall be laid before the ordinary tribunals.

Article 6. The Executive judges of the motives or considerations according to which the preference is to be given to one of various petitioners, preferring always him that should have first registered the denunciation and presented the ore found in the mine.

Article 7. From the moment that a mine is granted, even when it should be to the owner of the ground, or superfice, said property shall be distinct from the ownership of the ground, and considered as a new property upon which new mortgages can be laid without affecting those laid, or to be laid, on the superfice.

OF THE GRANTS.

Article 1. The petition for a grant shall be made to the Governor of the province, who is to register it under the same date, and order it immediately to be published by edicts. To the petition must be necessarily accompanied a registered document proving that the petitioner has definitely bargained with the owner of the superfice, except it should be him that asks for the grant, or that it should be on grounds belonging to the nation or commons.

Article 2. Said edicts shall be published during thirty days in the capital of the province and in the ward where the mine is located. They shall be also published in some periodical or journal should there be any published in the province.

Article 3. The secretary of the Governor shall deliver to the petitioner a certified copy of the record of his petition.

Article 4. The petitions in competition and the oppositions that should have been made, shall be admitted by the same Governor until the last of the thirty days fixed, counted from the day of the edicts, and shall also be recorded in the same manner as the principal petition. The oppositions shall be notified to the persons concerned, and the records shall be exhibited to all those that may wish information.

Article 5. At the expiration of the thirty days, and the requisites prescribed in the foregoing articles having been complied with, the Governor of the Province shall remit all the proceedings to the Secretary of the Interior.

Article 6. The Executive shall decide definitely in regard to the petitions for grants, and no opposition shall be admitted by the Secretary of the Interior unless said opposition should refer to the ownership of the mine acquired by a grant or otherwise, and only then it shall be ordered that the parties should apply to the ordinary tribunals to dispute their rights.

Article 7. The extent of the grant shall be determined in the writ of cession; it shall be limited by fixed spots taken on the surface of the ground and figuring vertical planes drawn from the superfice toward the interior of the ground to an indefinite depth, unless the circumstances and the locality should require another class of limitation.

The extent of each cession shall be of 1200 varas if the vein is vertical, and of 2400 varas if it should be horizontal.

Article 8. Several cessions can be possessed by the same person individually, or the representative of a company; but always with the obligation of having in operation the workings of each cession.

Article 9. The yieldings of the mines worked in Venezuela shall be exempted from all national and municipal duties, including tolls, during twenty years, to be counted from the publication of the present law.

Article 10. The engines, tools, apparatus and other implements imported for the working of said mines, shall be likewise exempted from import duties during the same time of twenty years.

The exemptions granted by this article do not comprehend the port charges that are to be paid by the vessels in which the minerals should be shipped, nor of those that may import the machinery, tools and other implements for their working.

Article 11. A premium of six reals 55 82-100ths cents] per tun is granted to the extraction of mineral coals, and eight reals per tun for the extraction of sulphur, alum, the nitrates with basis of soda or potash, and the sulphates

with metallic basis, during five years; said premium shall be paid out of the one per cent. of the total import duties, assigning the amount that may be necessary for the first year in the estimates of public expenditures.

Article 12. The gold and silver extracted out of the mines worked in Venezuela and that may be coined in the country, shall only pay as coining fees 5 per cent. the former and 2½ per cent. the latter, without being liable to any other duty or charges of whatever kind.

Article 13. The owners of mines that should establish in the country founderies for the fusion and separation of metals, shall own 2000 square varas of public lands given by the Executive, contiguous to the mine, if there should be any, or in any other spot of the neighborhood when they may require it, to enable them to put up all the offices or workhouses and other establishments they may need.

Article 14. The owners of mines can trace and open roads through the spots that they may think convenient to facilitate their operations, paying, according to experts' judgment, the damages occasioned to any other private owner through whose lands the road is to pass.

Article 15. When, on account of the neighborhood or of any other motive, the digging works of a mine should occasion damages to those of another by the water penetrating in the latter in greater quantity, or when otherwise the same workings should produce a contrary effect with a tendency to displace the whole or part of the waters of another mine, it will give occasion for an indemnification valued by experts.

Article 16. When many mines located in different cessions should be injured or threatened by a common inundation of such a nature as to endanger public security, the Executive can oblige the grantees of said mines to carry out in common, and at their own expense, the necessary works to dry the whole or part of the inundated mines to stop the progress of the inundation.

Article 17. The application of this measure must be preceded by an official proof to which all the persons concerned shall be summoned, and the form of which shall be prescribed by a regulation of the Executive.

Article 18. The Executive shall decide according to the merits of the proofs which are the inundated cessions, or those threatened by an inundation, that must carry out the drying works at their common expense. Said decision must be officially notified to the grantees concerned.

Article 19. All the disputes concerning the indemnifications that are to be made by the owners of mines on account of investigation or works previous to the act of cession, must be decided by a tribunal of arbitrators constituted according to law.

OF THE SUPERINTENDENCE OF THE MINES.

Article 1. The Executive shall appoint mining engineers, that under the orders of the Secretary of the Interior and the Governors, may watch the preservation of the buildings and the safety of the grounds.

Article 2. Said engineers have to watch the manner in which the diggings are carried out, to inform the owners of their inconveniences or their improvements, or to inform the Executive Governor of the faults, misapplication or dangers to which they are exposed.

Article 3. If the diggings endanger the public security, the preservation of wells, the firmness of the works, the safety of the laborers or the buildings of the superfice, the Governor shall act then according to the police regulations.

Article 4. The Executive, at the time of appointing an engineer, shall assign in his commission the salary he is to get and the mine that he is to superintend, notwitstanding that by a separate communication he may give him those instructions deemed necessary.

OF THE GRANTS GIVEN PREVIOUS TO THE PRESENT CODE.

Article 1. Those persons that should have obtained grants previous to the present law shall become, from the day of its publication, incommutable

owners, without previously requiring edicts, measurement of grounds, or other preliminaries, and with the only obligation of carrying out the bargains they should have made with the owners of the superfice.

Article 2. The anterior grantees shall enjoy in full force all the advantages offered by the present law; and in like manner shall submit to the duties said law establishes.

OF THE EXPERTS.

Article 1. In those cases foreseen by the present code and others, derived from circumstances requiring the judgment of experts, from 17th to 25th articles, 4th law, 1st title of the statute law, shall be applied.

Article 2. The experts shall be appointed from among the engineers or surveyors residing in the province where the mine is located, or, in default of these, from among the persons skilled in mining matters and their works.

Article 3. No plan or design shall be admitted in class of proof in a controversy, if it has not been made by an engineer.

Article 4. The expenses and salary of the experts shall be regulated by the tribunals, as likewise the fees that might correspond to the mining engineers, all according to a tariff framed by the Supreme Court of Justice. But the mining engineers shall have no right to said fees in the performance of public vigilance and order.

Article 5. The tribunal can order the promoter to deliver the sum deemed necessary to pay the expenses of a pretended judgment of experts.

OF THE ORDER AND LEGAL POWER CONCERNING MINES.

Article 1. The violations of the laws and regulations incurred by the digging owners of mines that have not yet been granted, or of other persons, shall be denounced and judged as the violations in matters of public order.

Article 2. The penalties shall be from twenty-five to two hundred pesos, and double that amount in case of relapse. From ten to thirty days of correctional imprisonment can also be imposed, save the damages and injuries resulting to the parties.

GENERAL DISPOSITIONS.

Article 1. The Executive shall order what may be convenient, that an intelligent and practical person may be employed in the discovery of the mines of the Republic, keeping a record of the quality, richness, location and other circumstances; with which object the sum deemed necessary shall be assigned in the estimates of public expenditures of the present year.

Article 2. The Executive shall order to be published in the most accredited periodicals of the States of America deemed convenient, and also in Europe, the present law regulating it for its best success.

Article 3. All other laws, decrees or ordinances concerning the mines, anterior to the present code, are hereby abolished.

COMMERCIAL ASPECT OF THE MINING INTEREST.

NEW YORK, *October* 31, 1854.

WE have no improvement to record in the market for mining stocks. A grievous want of money is shown by many companies, which has compelled a temporary suspension of the works. The want of foresight in not providing a cash capital for working their mines has destroyed the value of the stock

of many companies. The property of the North Carolina Company, which was placed in the hands of a trustee, James Sloan, as security for the debts contracted by the Company, was ordered for sale on the 15th November. We understand that a few of the largest stockholders purpose buying the mine. The wide distribution of the stock has prevented any combined effort to sustain the Company, as it had no power to make and enforce an assessment, and the majority of the stockholders would not volunteer one. A new Company, therefore, is likely to spring out of the old one. The *MacCulloch* Mining Company has to sustain difficulties from want of money. Some judgment debts exist, and the president is a large creditor of the Company. The mine, nevertheless, is said to yield considerable products. *Gold Hill* Mining stock has fallen to two dollars per share, and is in less favor than formerly, yet it is the most salable of all the mineral stocks, of which so few are marketable. The terms on which the *Ohio* Land Marble Company has sold its property is one dollar per share, the buyer surrendering his own stock of which he holds 15,000 shares, and the payment of all outstanding debts. The purchase money is to be in mortgage bonds, redeemable in two years, or sooner, at the pleasure of the buyer. The pressure of the debts incurred led to the sale, on these terms, far below the value of the property. Mismanagement is the cause of the ruin of the concern. The directors of the *Pittsburgh and Boston* Mining Company, commonly known as the *Cliff* Company, has declared a dividend of eight dollars per share, payable in Pittsburgh or Boston. This Company declared a dividend of ten dollars per share only in February last, making $18 within the year, which is the amount of all the assessments ever made. It is cheering to have to record even one mine that pays dividends in the very general dearth of such returns to mining adventure. The *Cliff* Mine is the crack mine of Lake Superior, and the Minnesota is next unto it. Many new companies, we find, are ready to start, the moment any encouragement is afforded by the money market, which, however, is still adverse to new enterprises. The monetary pressure has been very severe this month, more so than at any preceding month of the year. Hard money times commenced last August twelvemonth, and have continued hardening ever since; receiving at the revelation of the gigantic Schuyler fraud a more heavy, downward impetus. Schuyler was largely interested in the lead mines situated in Mineral Point, Wis., to which a railroad was constructed on contract by him.

The Directors of the *Fulton* Mining Company have made a report, in which they state they intend to call, shortly, a meeting of the stockholders, to propose a reduction of the amount of stock, which is injuriously large for their interests. The mine is being worked under favorable circumstances.

We mentioned last month that a number of mining companies had been formed to work the rich copper mines of Vermont; and gave particulars of one of them, the *Vermont* Copper Company. We now give some particulars of a second, the *Belmont* Mining Company. Their property is situated in Orange County, Vt., comprising two distinct tracts, the more northerly lying in the town of Corinth, and the southerly portion about six miles towards Vershire. The former portion lies south of the *Corinth* Company's lands,

and separated from them by the intervening property of the *Barnard* Company. It comprises 360 acres, owned in fee simple. A mill-brook or stream runs through it, falling forty feet in its passage, and affording good water-power. The thickness of the vein of ore is stated to be between seven and eight feet. The opening of the mine was commenced seven months ago. The ore on hand, on the 1st June, the mining captain estimated, would yield, when dressed, 50 tons of fifteen per cent. of ore, worth about three or four thousand dollars, and the expenses up to that time amounted to $1,000. The vein is composed of the yellow sulphuret of copper, with a small intermixture of the black oxide, green carbonate and variegated copper pyrites; with this is mixed a considerable proportion of magnetic iron pyrites, the ordinary iron pyrites or sulphuret of iron. The southern portion of the property contains about 800 acres, two miles long on the course of one vein; 500 acres are owned in fee, and 300 acres in mineral rights. The veins are of like character with those of the northern portion.

The coal stocks that are in good report are the Reading, the Cumberland, the Delaware and Hudson Canal Company, and the Pennsylvania Company. The two former are speculative or fancy stocks; the two latter, regular dividend paying ones; and are held firmly by parties who do not think of selling. The other stocks are active. Reading has fluctuated considerably from the speculations of the Philadelphia operators. These are non-inclined to purchase. The Company is in considerable debt, though doing a very large and profitable business. It is hoped that the passing of the dividend and its increased profits will enable it to recover itself.

The canals running through the Maryland coal district have again become fully supplied with water, and the consequence is that full supplies of coal come forward. The *Cumberland* Coal Company has again been bringing, the last three weeks, over 1,000 tons of coal per diem. It is calculated that the whole Cumberland Coal district will yield, this current year, 700,000 tons. The *Hampshire* Coal Company are on the eve of bringing regular supplies of coal to market, for which it has peculiar advantages, in its mines being by the side of the railroad. We shall have occasion to speak of this next month. About the 1st January, also, the Delaware and Lackawanna Railroad will be finished. This is a coal company having extensive coal fields, and will prove of great advantage to New York.

Among the gold mines of North Carolina, the *Howie and Lawson* are in a most prosperous condition, and promise soon to become a second *Gold Hill.* There are worked several veins, one of which yields from 5 to 50 dollars per bushel. The mill has lately been started, and before long, large returns may safely be expected. The success at those mines will probably induce the Company to recommence operations at the Washington mine. The *Wiatt* Mine, adjacent to the *Lawson* and *Washington*, will also soon be re-opened.

At *Rudisel Hill*, near Charlotte, several rich gold-bearing veins are worked; one of them measuring five feet in thickness. One of Sanford's Crushers and Amalgamators has been adapted for working the ore, and we have no doubt that this ingenious and efficacious machine will soon be in general use in this region.

At *Copper Hill*, a number of Bradford's shaking tables are put in operation, and the mine is in a prosperous condition. Gold is also being earned at the *McGwin* Mine, while the prospect for copper is improving with the extension of the underground works in depth.

In Burke County, several rich gold deposits will soon be worked on a large scale, on a plan lately adopted in California.

At the *Pioneer* Mine, the preparatory works are well progressing, and the mine will soon be in working order.

At the *Smart* Mine, the silver lead vein is two feet wide in the bottom of the shaft, at a depth of only 75 feet. Fine workable ores are being raised from it, a quantity of which is being sent to the North for smelting and cupellation. A smelting furnace will soon be erected near the mine. The gold veins are also in a progressing condition, and within a few weeks, the mills will be finished and in operation.

At the *Wentz* Mine, a trial shaft has been sunk on a well-defined copper vein, which was struck at a depth of 44 feet, being several feet wide, and of a very promising appearance. Three other veins have been opened on this property, one of which measures five feet in thickness.

At the *Carrither* Mine, where two fine copper veins were opened, which are also rich as gold, an extensive exploration will soon be made.

Tin has been found in North Carolina by Professor Ellery.

The transactions at the Stock Board have been limited to three or four companies, and we have therefore omitted this month our usual table.

BOSTON MINING SHARE MARKET.

Boston, *Oct.* 31, 1854.

The mining share market presents no changes of a favorable nature, as regards the prices of different stocks, and generally the quotations rule lower than a month since, with very few buyers or sellers. It is a gratifying fact, however, to notice that the latter have materially diminished, and holders of stock are becoming satisfied that it is best to see the end, without sacrificing their property at the ruinously low rates now current.

Although the product of the present year will far exceed that of 1853, the sanguine expectations of the managers of copper mining companies have not been realized, the actual facts falling much short of what we had been led to expect. This is an evil, natural in all new enterprises however, and cannot be remedied, except that future predictions should gain wisdom from past experience and be calculated upon a basis of greater firmness, supported by facts. Undoubtedly too much is expected from mining enterprises, and we are not willing to look at the matter as it is, but begin to figure *results* in many instances, even before the first operations have been commenced on the mining ground. Mines worked out on paper *look* well, but there must be something besides that to make them *pay* well. Time, money, labor and skill, blended with indomitable perseverance on the part of those who have the *immediate* management of the property, are all indispensable to success, and without them it is useless even to *hope* for the attainment of any desirable end. There is another part of the work too, which needs a

little improvement, and we refer to those who are placed in the direction of the affairs of the different companies. An important error is committed here, which would not be tolerated for a moment by any business man in conducting his own affairs. Men are chosen as directors, in many instances, who are totally unfit for the post they occupy, knowing little and caring less, what is best for the interests of the company, and having their own affairs to look out for, give little heed to the requirements of the mining property, which, it is generally supposed, will take care of itself, if assessments can be laid fast enough to furnish funds. To our mind it would be an improvement to have a very small number of directors,—three is sufficient,—and let them be *paid*, if necessary, a moderate salary to *give attention* to the wants of the mine and use their energies to best promote its interests. Although objections may be urged against *paying* the directors, as being an additional and useless expense, we are of the opinion that it would be *money saved*, in the end, as services "free gratis" are not always the most disinterested. If a man works for you, pay him, and see, too, that he does his work faithfully. As at present managed, a few men "get up" a mining company, with, perhaps, $2 paid in, and after disposing of all the stock, *get out*, financially, much to *their own* satisfaction. We are well aware that *all* companies are not managed in this way, but the whole matter *needs looking after*, and unless we have a reform, it will soon be difficult to start a mine at all, let the promises of future results be ever so flattering.

The market for mining stocks is flat enough, and the shares generally are in bad repute with inventors; and as to speculation, the thing is not known at the present time. "Bulls" and "bears" are terms almost obsolete, and the "ups and downs" of the market, frequently alluded to in former times are all of the latter class, graduated on an inclined plane of the most approved description!

Pittsburg (Cliff Mine) has depreciated about $10 per share (130 now asked) since the report came out, it not being deemed satisfactory by stockholders. It is quite evident that the managers have been making too much of a *show* by declaring large dividends, in fact *entirely clearing out the treasury* to pay them, and now they have just come to the sensible conclusion, that a reserve fund of $100,000 is necessary for *working capital*, to enable the company's affairs to be carried on successfully, and without being continually "short" of funds. In order to accomplish this, the directors say, "We are of the opinion that the working capital should be increased until it shall amount to a sum equal at least to one half of the ordinary yearly expenditures. This may be done without calling upon the stockholders for an increase of the capital stock, which is by no means advisable or desirable, but by *hereafter withholding a portion of the annual earnings*." The directors do not inform us whether they intend withholding *all* the amount required in *one* year, which would just about consume the entire net profits (the dividends in 1854 being $108,000), or, if their intention is to reserve a portion each year until the desired sum shall be realized. In the first case no dividend could be expected in 1855, and should the latter course be decided on, reduced dividends must be made for several years. Had the company never paid over *ten dollars per*

share, each year, the cash surplus would *now* be $102,000, and every shareholder would have been perfectly satisfied with the income from his property. For the years 1853 and 1854, the company paid $32 per share, so that in *these two years* alone $78,000 might have been reserved, by paying semi-annual dividends of but $5 per share.

Copper Falls stock has declined to 37½, in consequence of an anticipated assessment of probably $7 per share, which will be decided upon by a special meeting of the stockholders, Nov. 14. This step has been rendered necessary by the fact that the shipments of copper for 1854 will be less than 175 tons, instead of 400, as was promised by Mr. Hill, the agent, at the time the last assessment of $5 per share was levied. Various circumstances have operated against getting the copper forward for shipment, the main one being want of machinery to stamp it out. This trouble is fast being remedied, and the mine will speak for itself another season, as there is an immense amount of stamp stuff now on hand, and the mine will produce it as fast as 100 heads of stamps (the contemplated number) can prepare it for shipment. We believe the managers still hope to pay the stockholders a dividend in 1855.

The following assessments have been levied since our last, and although some of them are past due, we publish them as a record for future reference.

COMPANIES.	AMOUNT PER SHARE.	WHEN PAYABLE.	WHERE PAYABLE.
Adventure,	$1,	November 6,	Pittsburgh, Pa.
Siskowit,	50 cts.	November 6,	Philadelphia, Pa.
National,	$1,	November 6,	Pittsburgh, Pa.
Isle Royale,	$1,	November 15,	Washington, D. C.
Isle Royale,	$1,	December 15,	Washington, D. C.
Isle Royale,	$1,	January 15, '55,	Washington, D. C.
Phoenix,	$1,	November 17,	Boston.
Portage,	50 cts.	November 20,	Detroit, Mich.

The above assessment on the *Portage* is the last of the $1.50 laid some months since, 50 cents of which became due September 20, and 50 cents October 20. The *Adventure* and *National* are payable by Eastern stockholders at the office of Messrs. J. W. Clark & Co., Boston. *Isle Royale* also at Boston to Messrs. Head & Perkins.

The *Isle Royale* mine is looking remarkably well, and the managers are determined to push the work to a dividend paying point at the earliest practicable day. $4 have already been paid in since January, 1854, making with the above assessments $7 per share in one year. The frequent calling for assessments, together with the unfavorable state of the stock market generally, has had a depressing influence on the market value of the stock, which is not much above $10 per share, having fallen from $24 per share in March, since which $3 has been paid in, making a net loss of $17 per share.

Toltec has settled down to $5½ with $8 per share paid in. This stock has also declined largely, having fallen from $12 since March last; $4 per share having been paid in since, the loss exceeds $10 per share. The stock is considered very cheap at the present selling price, as the mine promises equal to any at the lake, for the amount of work done upon it. It is hoped that one more assessment, next spring, of $2 per share or more, will carry it to a paying point.

Forest has been very dull of sale for some time past, owing to the heavy assessment of $5 per share ($3 of which was paid in October 13, and the balance is due January 2, 1855,) making a total of $20 per share, which the managers announce as the *final* assessment needed to bring the mine to a paying point. The prospects are now very encouraging, and it is anticipated that the mine will make good progress the coming winter. The stock sells at $8 per share, and is heavy at the present writing. The accounts from the mine, recently, are very encouraging.

Phœnix is looking very well, indeed, and the work is being pushed forward as rapidly as possible. The vein is steadily improving in richness, and gives abundant promise of eventual success. A report of the present condition of the mine and its future prospects is shortly to be printed and circulated among the stockholders, when they can judge of their property for themselves.

BOSTON MINING SHARE LIST.

Fluctuations for September, 1854, in thirty-one different Mining Stocks, sold at the Boston Stock and Exchange Board, showing their Highest and Lowest Points, and the Date, with the Market Value at the close of the Month, Gain or Loss for the Month, and number of Shares sold in each.

Mining Stocks, Boston.	Nominal Capital.	Shares.	Par.	Paid in Oct. 20.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value Sept. 30.	From Aug. 31. Gain.	From Aug. 31. Loss.	Shares sold in Sept.	Value Oct. 20.
Adventure, *Copper*	$250,000	10,000	25	$11.00					1			No sale.	¾
Algomah	500,000	20,000	25	2.37½	1¼	3	1¼	13	1		¼	210	¾
Bay State	200,000	20,000	25	12.00					1¼			No sale.	1
Bohemian	250,000	16,666	15	4.94					1¼			No sale.	
Boston	100,000	20,000	25	12.00					½		½	No sale.	
Copper Falls	300,000	10,000	30	18.00	54	6	40	30	40		14	94	28
Dana	500,000	20,000	25	1.62½	1¼	27	1¼	27	¾		¼	100	¾
Forest	200,000	10,000	20	18.00	9¼	12	9¼	12	6		4	10	18½
Fulton	500,000	100,000	5	12.00	1	2	1	13	½		½	500	¾
Glen	500,000	20,000	25	12.00					½		½	No sale.	
Isle Royale	120,000	12,000	10	10.00	15¾	13	15¾	13	15	¾		10	13
Malone, *Sandstone*	400,000	40,000	10	3 12½	45	5	45	18	45		2	300	45
Manassas, *Mining*	1,000,000	100,000	10	12.00					¼			No sale.	
Manitou, *Copper*	500,000	20,000	25	0.75					¼			No sale.	¼
Minnesota	300,000	3,000	100	22.00					176			No sale.	170
National	250,000	10,000	25	3.00					18		2	No sale.	18
Native	250,000	10,000	25	4.75					1		¾	No sale.	¾
North American	300,000	10,000	30	21.50					60		2	No sale.	60
Norwich	100,000	20,000	5	15.00					4		1	No sale.	4
North Western	300,000	6,000	33½	14.67					20		2	No sale.	20
Phœnix	300,000	10,000	30	7.00	6¼	11	6¼	11	6		1¼	10	4
Pittsburg (*Clift*)	—	6,000	—	18.50	*140	20	*140	22	*139		1	17	130
Ridge	—	10,000	—	6.50					⅝		⅜	No sale.	⅝
Ripley	500,000	40,000	12½	2.75					1		¼	No sale.	
Shawmut	500,000	20,000	25	3.00					¼			No sale.	
Star	500,000	20,000	25	5.50					5			No sale.	5
Summit	500,000	40,000	12½	15.00					5		1	No sale.	5
Tolec	500,000	20,000	25	8.00	†7	1	†6	26	6		1	600	5¾
Winthrop	500,000	20,000	25	1.25	1¼	27	1¼	23	1¼	¼		350	1¼
Webster	200,000	40,000	5	12.00					¼		¼	No sale.	
W. Castleton, *Slate*	1,000,000	50,000	20	16.00					2			No sale.	2

* Pittsburg Co., ex dividend, $8 per share. † Assessment paid.
‡ These are fully paid stock, not assessable without a vote of the shareholders.

One dollar was paid in on the *Algomah*, October 16; *Forest*, $3, October 18; and *Manitou* and *Ripley*, each 50 cents, September 25, all of which are included in the amounts paid in above.

As we shall hereafter publish in each number of the Magazine the fluctuations in the *Mining Share Market* for the month immediately preceding, we give below those of November, to make the series complete to this time:

Fluctuations for October, 1854, in thirty-one different Mining Stocks, sold at the Boston Stock and Exchange Board, showing their Highest and Lowest Points, and the Date, with the Market Value at the close of the month, Gain or Loss for the month, and Number of Shares sold in each.

Mining Stocks, Boston.	Paid in Oct. 31.	Highest Sales.	Day Mon.	Lowest Sales.	Day Mon.	Value Oct. 31.	From Sept. 30. Gain.	From Sept. 30. Loss.	Shares sold in October.
Adventure, *Copper*	$11.00	—	—	—	—	¼	—	¼	No sale.
Algomah	2.37½	—	—	—	—	*2	0	0	No sale.
Bay State	2.00	—	—	—	—	¼	0	0	No sale.
Bohemian	4.94	—	—	—	—	1	0	0	No sale.
Boston	2.00	—	—	—	—	—	—	—	No sale.
Copper Falls	18.00	40	2	38	24	38	—	2½	99
Dana	1.62½	½	31	½	31	½	—	½	100
Forest	18.00	*3½	23	3	13	*3¼	—	¼	50
Fulton	2.00	50	16	45	25	40	—	10	1113
Glen	2.00	—	—	—	—	¼	0	0	No sale.
Isle Royale	10.00	13	14	10	9	12½	—	2½	140
Malone, *Sandstone*	3.12½	44	3	40	27	45	0	0	517
Manassas, *Mining*	2.00	—	—	—	—	—	—	—	No sale.
Manitou, *Copper*	0.75	—	—	—	—	*¼	—	¼	No sale.
Minnesota	22.00	—	—	—	—	170	—	6	No sale.
National	3.00	—	—	—	—	18	0	0	No sale.
Native	4.75	—	—	—	—	¼	—	¼	No sale.
North American	21.50	—	—	—	—	60	0	0	No sale.
Norwich	5.00	4	20	4	25	4	0	0	100
North Western	14.67	—	—	—	—	20	0	0	No sale.
Phœnix	7.00	4	18	4	25	4	—	2	70
Pittsburg (*Cliff*)	18.50	132½	12	130	13	130	—	9	59
Ridge	6.50	—	—	—	—	5½	—	½	No sale.
Ripley	2.75	—	—	—	—	1	0	0	No sale
Shawmut	3.00	—	—	—	—	¼	0	0	No sale.
Star	5·50	—	—	—	—	5	0	0	No sale.
Summit	5.00	—	—	—	—	5	0	0	No sale
Toltec	8.00	5¼	2	5	10	5¼	—	¼	782
Winthrop	1.25	1¼	14	1	31	1¼	—	¼	200
Webster	2.00	—	—	—	—	¼	—	¼	No sale.
W. Castleton, *Slate*	6.00	—	—	—	—	2	0	0	No sale.

* Assessment paid.

Minnesota is dull at 170, without buyers, although the stock is probably one of the cheapest on the list, as the company comprises only 8,000 shares, has a surplus of $50,000 on hand, and is producing copper enough each season to pay handsome dividends to the shareholders.

North American is little inquired for in this market, the last sales being at about 60, which is not high for the stock, as the time of their first dividend is not far distant, and doubtless the payments will be continued regularly after once commenced.

North Western is dull at about 20, but the recent accounts from the mine are so favorable that the stock is not pressed for sale. The latter two companies are Pittsburg concerns, and usually the transactions in the stock here are much limited. They both rank well, however, and will eventually become first class mines, and that too without any great delay.

Among the "young mines" (so called), the *Winthrop* stands well, and promises to make a good show as its resources are developed. The fact of its

having the "Hill Vein" of the Copper Falls, renders it a matter of certainty that the mine will come out right in due time. *Algomah* also has a promising vein, the same which the *Toltec* are now working, and there is every reason to believe that it will make a productive mine. *Star* is improving and grows richer as the work progresses deeper, which is a very favorable indication. There is every reason for predicting that it will become a first-class property. The *Dana*, as also the *Native*, appear to have very good veins, but for the present work has been stopped, in consequence of the very heavy expenses of mining at this time and the difficulty of raising money from assessments. The *Fulton* has a valuable mining property, but the very bad *financial* management of the concern, has rendered the stock unpopular, and it will not bring 50 cents per share at this time. The company appears to have spent all the proceeds of the sale of their stock, and now it is proposed to reduce the share (100,000) to 20,000, and then probably an assessment of $1 per share will be levied. Of *Bay State*, *Bohemian*, *Glen*, *Nebraska*, *Ripley*, *Shaumut* and *Webster*, we hear little of importance. The last two are offered at 25 cents per share, and probably no more than that price could be obtained for either of the seven.

NEW YORK, *Nov. 30th*, 1854.

The state of the money market, and the want of real value found to attach to so many of the mines, the stocks of which have been before the public, continue to work against the revival of activity in the mining share market. The abundance of money in market is only felt when its circulation is quick. If the circulation be quick, its positive amount is not of so much moment. A nimble sixpence, says the proverb, is worth more than a dull shilling. So it is now. The want of confidence and spirit prevents the free use of what money there is, and the actual amount of money may be greater in the hands of capitalists at the present moment than in the most buoyant times. The amount must be multiplied by the sluggishness or quickness of circulation to ascertain its force. The momentum with which money is made to circulate impelled by confidence or speculation, makes the market appear abundant or otherwise.

At present all is sluggishness. Large amounts may be invested, but the investment stops there, they give no force or quickness to the currency. Liquidation and contraction still go on, and while this is the case the market must show less and less abundance. Exchanges become fewer, and those who have debts to pay obtain no advantage such as they could do by a quick circulation and large transactions.

The quantity of shares held in various unproductive enterprises, must be immense. The several undertakings, mining and otherwise, which have been overtaken by monetary difficulties before they have made any way towards productive completion, have deprived those who have made investments in them of any benefit from such investments. Had a few companies pursued their work to completion, instead of a multitude who are obliged to stop half way, the difficulties would have been few, and benefit have been received from the investments.

The whole market is indiscriminately dull, and the stock of the best enterprises without exchangeable value.

Gold Hill shares which maintained a sort of prestige for some time past, have at length lost it. It is announced that the dividends are to be suspended. The gold mined is wanted to pay a floating debt which has of late accumulated. The shares have consequently fallen fifty per cent., that is, from two to one dollar per share. The *Phœnix Coal Company* is winding up. A meeting of the stockholders has been held this month, in which it was resolved to authorize the directors to sell or assign the property for the benefit of the stockholders. The President stated that six dollars per share would be wanted to pay off incumbrances, but the stockholders would not agree to pay.

Renewed efforts are making to restore the *Parker Vein Coal Company* to life and action. The Maryland legislature, from which it holds its charter, does not meet till December, 1855, consequently no immediate relief can be expected thence; but it has been proposed by the present directors that the holders of stock, including the over-issues, should give up a per centage so as to reduce the issues to the legal amount under the charter; but to receive in return from the Company certificates of indebtedness at the par value of $5, bearing interest at 6 per cent. per annum, and in order to provide a working capital, to subscribe in cash $1 25 for each certificate, the subscriptions to be on the bonds of the Company, also bearing 6 per cent. annual interest. If this be done, as the property is considered to be valuable, the stockholders may be protected. The men who are connected with the over-issues, having equal turpitude but more effrontery than the great Schuyler, are endeavoring to prevent the realization of the plan, and to force the property to sale under the assignment made by the old directors, and which property they want to buy cheap and form into a new company.

The *Langollen Mining Company* has also gone out of existence. Its shares are valueless. Its property has been taken in execution.

The *Reid Mining Company* is entirely defunct.

The *Cumberland Coal Company* is the only stable coal company of the Maryland district, though another one, of undoubted value, is about to appear.

The *Hampshire Coal Company* has been working in silence for some time, but has now opened its pits, and is sending coal to market. Its property is valuable, and is under the very energetic management of General Tyson. Its stock is not on the market. The Cumberland Coal Company's shares have been affected a little in value by the state of the money and stock markets, but it is fully available in the market for raising money, which is of itself a test of value. The profits for the year ending with the close of December, will enable the Company either to declare a dividend, or to pay off a portion of the bonded indebtedness, anticipating the time of its maturity. The latter will probably be done.

The *Tennessee and Lake Superior Mining Companies* are pursuing their operations with great steadiness.

The *Isabella Mine*, of Polk County, the queen of mines as to productiveness, will yield abundantly this season.

The *Callaway*, *East Tennessee* and *Cherokee*, are also among the best mines of the district; and will be profitable investments.

Patience is required in all mining operations. More can not now be undertaken for the sake of working the Stock in Wall Street with earnestness, while they make only a show of working the mines.

BOSTON MINING SHARE MARKET.

BOSTON, *Dec.* 1, 1854.

The month of November was one of very great pressure in money matters, and its effects have been seriously felt on all new and unfinished enterprises, crushing the budding promises of many a bright and shining light. *Mining Enterprises* have suffered most seriously in the general stagnation, and have felt the want of capital for prosecuting their labors to a very great extent. Notwithstanding the very strong indications of success from the leading mines, there is a feeling of general apathy prevailing towards mining stocks, and although the present offers an exceedingly favorable opportunity for profitable investment in such securities, the fact seems to be entirely overlooked by those who are usually quicksighted enough to catch at a bargain.

The successful prosecution of mining has suffered very much in its estimation with the public, from the fact that former statements, put forth by parties acting under authority, have not been reliable, partaking too much of the "you tickle me and I'll tickle you" class of information. A plain, open, candid statement of *facts*, rather below than above the real merits, is what is needed to place upon a sure footing the various mining enterprises which have a *basis* to stand upon, and those that have *not*, the sooner they fall the better. When mining is conducted on the same principles as any other legitimate business, it will take a firm stand and enlist the attention of capitalists, who much prefer to take hold of any thing as a business matter with reasonable prospects of success, than to enlist for a mere speculation, which *may* be exceedingly profitable or may fail entirely. At the opening of another season, we hope to see mining operations assume a more permanent and reliable business shape, when their complete success will not admit of a doubt. It is true that some few of the mines have already reached a point of success, which establishes, in a measure, the eventual certainty of other enterprises. But their position has been reached by slow degrees, and with a dragging influence, which, at times, threatened to entirely annihilate their successful prospects, and to guard against this evil in the future, the practical experience of the past, if profited by, will prove most effectual.

The completion of the *Saut Canal*, which is now a "fixed fact," is one of the most important features for the success of Lake Superior Mining, that has been effected at any time since the first spade was struck into the ground of the copper region. It opens a new era in the mining success of that country, and gives joy to the hearts of those true spirits who have invested liberally in its mineral resources. Its cost of $1,000,000, will prove a most judicious outlay, and its vast benefit to the mining property cannot be estimated in advance. One year's trial of it will fully prove that it would not *then* be dispensed with at treble its cost.

Of the mining *stock* market, we can say little that is favorable, for the tone

has been "lower and lower yet," as time moves onward, and with the present close grip by which the "purse strings" are held, there is little reason to hope for "better times." But such a state of things will not last for ever, although we cannot discern any *immediate* prospects of improvement. The time will come, however, and we trust it is not far in the future, for a long continued monetary pressure, like that of the past month, would entirely swamp nearly every mining stock now current in the market. After the close of the year, we shall look forward with some degree of confidence to a gradual and permanent improvement in money matters, which would have a most satisfactory influence on all descriptions of property, and especially such as have a real value, although its existence cannot be made perfectly apparent, among which are many of the mining shares that appear from week to week in the sales of the Stock Exchange.

At a special meeting of the stockholders of the *Copper Falls* Co., Nov. 14, the Directors were authorized to levy assessments to the amount of ten dollars ($10) per share, at their discretion, and they have already called for $6, as will be seen below. The amount of copper shipped up to Oct. 23, was 122 tons, and the total for the season will hardly reach 150, which is a great falling off from the anticipations last spring. The mine has produced the "raw material" in sufficient quantity, however, but the want of machinery to work up the immense piles of stamp stuff now on the surface, has prevented so favorable results this season as had been hoped for. This deficiency is being remedied, however, as we have previously stated in these pages, by an increase of 24 heads of stamps (making 48 heads in all), to be in operation by Jan. 1855, and also two sets of *Ball's Patent Stamping and Washing Machinery*, equal to 50 heads, to be put up early next summer, so that another season the *Copper Falls* must send down a very large amount of copper. The immense working power of *one hundred* heads of stamps can be the better realized when we state that *thirty-six* is the largest number now in use by *any mine* on Lake Superior. Of course the calling of an assessment of $6 per share would unfavorably affect the stock, and the price has declined $14 per share within the month, the present selling price being $2¼, and even lower figures may be reached. The *market value* of a mining stock, however, has long since ceased to be a true criterion of its value, as represented by the property of the mine. Whatever may be the current price of the Copper Falls *stock*, the *mine* is sure of ultimate success, and that too even sooner than past experience would indicate. The mine has been opened on a plan *the most complete and systematic* of any at the Lake, and reflects great credit upon Samuel W. Hill, Esq., its indefatigable Engineer and Superintendent.

Toltec has declined from 5¼ to 3¼, although the mine is more prosperous than ever, and the stock is really worth *double* at least what it was a year ago, when selling at about $12, setting aside the $4 per share paid in since that time, which of course adds to its value. About seven hundred shares are advertised for sale at auction on the 30th of Dec. for non-payment of assessments, which undoubtedly tends to keep down the price, as parties are hoping to buy them cheaper, than even the rate now current. The present selling price is low beyond reason, and although the market value may de-

preciate still further, our confidence in the ultimate success of the mine is not in the least shaken, and the results of the year 1855, we feel assured, will fully demonstrate the truth of this position. The product of the mine is rich and abundant, and with a force of 48 heads of stamps another season, there can be little doubt of success, and such as will *tell* by its shipments of copper, beyond even the anticipations now.

Isle Royale has declined to $10, with $11 per share paid in, and $2 more have been called for, payable Dec. 15th and Jan. 15th, $1 each. Assessments have been called very freely on this stock, amounting to $7 per share since the 1st of March, 1854, including the $2 now pending. It should be recollected, however, that the number of shares is only 12,000, and consequently $5 per share is only equal to $3, in companies composed of 20,000 shares. The mine continues rich in all its parts, and the supply of mineral is very abundant. They have an immense amount of stamp stuff *already on the surface*, and eight heads of stamps are now in operation, which number will be increased to 24 by Jan. 1855. Some fears have been entertained that the copper would give out, as the mine increased *in depth*. But a specimen of vein stone from the *third level*, recently exhibited to us, spoils that theory, as it was *well charged* with copper, and renders it certain that the mine has great *depth* as well as length.

The only sale of *Forest* for Nov. was 50 shares at $8 on the 2d. Since that time the price has been working down, and $4 to $5 is now about the market value. The annual meeting of this Company is to be held Dec. 11, when some financial movement will be necessary for raising the funds needed to carry forward the work of further opening the mine. The last assessment of $5 per share (making in all $20) completes the amount of assessments allowed by the charter, and therefore some other measures must be adopted for raising $50,000 more, which will be required to bring the mine to a paying point. We hear a plan suggested of a loan from the stockholders, which is most likely to be carried out at the annual meeting, the details of which will then be made public. The Company lost $50,000 by the burning of their stamp works last spring, mostly in the delay of their mining operations, the actual pecuniary loss not being one tenth of that sum, but the ability to get forward copper for shipment was very much retarded. It is true, however, that the Company now have a much superior engine, with greater facilities for stamping out the copper, but all this has *cost money* necessarily, and kept back *copper*, which is the "back bone" of Mining Companies, and especially acceptable in times like these. Although we have had no details from the mine for some months, in consequence of Mr. Livingston's absence to visit the sick-bed of a near relative, what has been derived through other sources speaks well of the mine and its general prospects. We expect to hear very encouraging accounts from the *Forest* the coming winter, for although peculiarly unfortunate in the past, its future will yet shine prominently and produce a permanent light.

Pittsburg has still further declined and touched 120, a loss of $10 per share for November, and a decline of $25 within a few months. The mine is doing very well, but will hardly send forward so much copper as in 1853. The general expectation that no dividend will be paid for the 6 months ending

Feb., 1855, has caused many parties to sell, with the prospect of replacing their stock at lower figures some months hence.

Minnesota is dull and heavy at 160 asked, without buyers at any price just now. The mine is doing well, however, and from the shipments of copper, we should judge that their ability to pay a handsome dividend from the year's earnings was quite certain. It was currently reported, some time since, that they would divide $80 again this year, but we hear nothing of the matter lately, and this amount is rather higher probably than will be paid. We notice that they have recently caused to be prepared a map of *all* their property, which is to be lithographed, and, we hope, distributed among the shareholders, as it will tend very much to strengthen their confidence in the value of the property.

N. American has not sold in this market for some months, and 60 is now asked. The annual meeting of this Company is expected to be held some time the present month, when a favorable report is anticipated. *N. Western* sold at 20 a short time since, and that is about the price now. The prospects of the mine are looking well, but the fear of further assessments hangs over it. At the time of the last annual report, the Directors *hoped* to carry forward their operations without further call upon the shareholders, and possibly this favorable result may be attained.

The following assessments have been laid since our last, that of the *Nebraska* being already due.

Cos.	Amt. per share.	When pble.	Where pble.
Nebraska,	50 cents.	Nov. 28,	Detroit, Mich.
National,	$2,	Dec. 15,	Pittsburg, Pa.
Copper Falls,	$6,	Dec. 20,	Boston.
Winthrop,	25 cents.,	Jan. 10, '55,	Boston.
Toltec,	$1,	Jan. 8, '55,	Boston.

A discount of five per cent. will be allowed on all the *Toltec* assessments paid on or before Dec. 20.

This assessment of $1 per share on the *Toltec*, has come out since penning the remarks as to this Company above, and was entirely unexpected, as the managers have repeatedly stated to us that no farther calls would be necessary until next spring, and on that authority we have previously made such an announcement. It now turns out that drafts for supplies have come forward in larger amounts than had been anticipated at present, all being dated the same day. This of course renders it necessary to assess for more money, as it is difficult to borrow at any price, under the present state of money matters, and consequently the stock is dull at $3 per share.

The *National* assessments can be paid by Eastern stockholders to Messrs. J. W. Clark & Co., Boston. In consequence of heavy assessments and the unsettled lawsuit with the *Minnesota Co.*, the stock of the *National* has depreciated in market value, and would not now bring more than $12 to $15 per share if forced to be sold. Very little of the stock comes into the market, however, which is favorable for preventing a reduction in price. Accounts from the mine are encouraging, and its general prospects are highly flattering. Including the assessment noted above, the total amount paid in will be $6 per share.

The annual meeting of the *Huron Copper Mining Co.* was held at the

Treasurer's office in this city, Dec. 4, when the following Board of Directors was elected:

Wm. B. Heywood, President, of Boston.
E. D. Baigham, "
Elisha T. Loring, "
Horatio Bigelow, "
Jacob B. Bennett, Lake Superior.

Horatio Bigelow, Esq., was re-elected Secretary and Treasurer.

The *Huron* mine has been operated but a short time, and for the amount of work performed presents a most remarkable appearance, being exceedingly rich in all its parts. The agent writes that "the workings at the *Huron* thus far promise as well as do the *Isle Royale* on the same lode. The occurrence of copper in these two lodes (the *Isle Royale* and *Portage*) is unlike *any thing yet known in the history of mining*. The lode is of good width, with a general distribution of copper in strings, as well as disseminated through the rock, and small irregular shaped masses are frequently met with."

The *Huron* promises well, and although less than $1 per share has been paid in private, sales have lately been made at *seven* dollars, which speaks strongly for the *mine* in these times.

The *Phœnix* mine has been steadily improving throughout the past season, and now gives excellent evidence of success. The vein is growing richer and widens as the work is extended on it. Notwithstanding these favorable indications the stock is very much depressed, and cannot be sold at $4, including the $1 per share assessment paid in Nov. 17, and the total assessments now amount to $8 per share on 10,000 shares. The work at the mine is being pushed forward with vigor, and we look for good results from the *Phœnix* another season. The *Ridge* has been doing well the past year, and makes a better "show" now than at any time since the mine was opened. The stock is not much known here, and it is doubtful if a decent price could be obtained for it in such a market as now prevails. The *Star* mine is steadily gaining, and for the extent of its development presents a highly favorable appearance. The stock is well held and seldom comes into the market, which is very fortunate for its current value. *Norwich* is in poor demand at $4, owing to the financial difficulties of the Company, but the *mine* presents a good appearance, and has sent forward considerable copper. *Winthrop* is dull of sale at $1, though it is richly worth much more, from the present appearance of the mine. It is known that this Company have the celebrated "Hill Vein" of the Copper Falls, which will be made to *tell* so soon as money becomes moderately abundant, that the work of opening up the mine may be carried on with increased energy. *Algomah* makes a very good show, and having the "Toltec Vein" it is a sure thing, with a proper expenditure of money, and untiring perseverance, without which it is of little use to attempt bringing any mine to a point of profit.

Most of the Companies included in the following table, and not specially mentioned above, are valued at $1 to $0 per share, so far as the present *selling price* of the shares is concerned, but several of the mines are looking well, and some of the concerns undoubtedly have a valuable property, which will be revealed at a future time. It is but little use now to extol their va-

rious merits *on paper*, as there is little satisfaction to the practical mind in such demonstrations of probable success.

BOSTON MINING SHARE LIST.

Fluctuations for November, 1854, in thirty-one different Mining Stocks, sold at the Boston Stock and Exchange Board, showing their Highest and Lowest Points, and the Date, with the Market Value at the close of the Month, Gain or Loss for the Month, and number of Shares sold in each.

Mining Stocks, Boston.	Nominal Capital.	Shares.	Par.	Paid in Nov. 30.	Highest Sales.	Day of Mon.	Lowest Sales.	Day of Mon.	Value Nov. 30.	From Oct. 31. Gain.	From Oct. 31. Loss.	Shares sold in Nov.	Shares sold in Oct.
Adventure, *Copper*	$250,000	10,000	25	$8.50					1¼	1		No sale.	No sale.
Algonah	500,000	20,000	25	2.37½					1½	¼		No sale.	No sale.
Bay State	500,000	20,000	25	12.00								No sale.	No sale.
Bohemian	250,000	16,666	15	4.94					1	⅛		No sale.	No sale.
Boston	500,000	20,000	25	12.00							12	No sale.	No sale.
Copper Falls	300,000	10,000	30	18.00	38	2	24¼	28	24	¼		643	59
Dana	500,000	20,000	25	1.62½								No sale.	100
Forest	200,000	10,000	20	18.00	8	2	8	2	6	¼		250	50
Fulton	600,000	100,000	5	12.00							34	No sale.	1,113
Glen	500,000	20,000	25	12.00								No sale.	No sale.
Isle Royale	120,000	12,000	10	11.00	12	1	10	22	10⅜	⅛		200	140
Malone, *Sandstone*	400,000	40,000	10	3.12½	50	3	45	8	45		2½	675	517
Manassas, *Mining*	1,000,000	100,000	10	12.00								No sale.	No sale.
Manitou, *Copper*	500,000	20,000	25	0.75								No sale.	No sale.
Minnesota	300,000	3,000	100	22.00	170	1	170	1	167		3	1	No sale.
National	250,000	10,000	25	4.00					15		3	No sale.	No sale.
Native	250,000	10,000	25	4.75								No sale.	No sale.
N. American	300,000	10,000	30	21.50					60	¼		No sale.	No sale.
Norwich	100,000	20,000	5	15.00					4			No sale.	100
North Western	300,000	9,000	33⅓	14.67	20	13	20	13	20			50	No sale.
Phœnix	300,000	10,000	30	8.00	4	1	4	23	4			150	70
Pittsburg (*Cliff*)	.....	6,000		18.00	128	7	120	23	120			41	69
Ridge	.....	10,000		6.50								No sale.	No sale.
Ripley	500,000	40,000	12½	2.75								60	No sale.
Shawmut	500,000	20,000	25	3.00								No sale.	No sale.
Star	500,000	20,000	25	5.50					4		1	No sale.	No sale.
Summit	500,000	40,000	12½	15.00					4		1	No sale.	No sale.
Tolec	500,000	20,000	25	8.00	64	1	34	23	38		14	961	782
Winthrop	500,000	20,000	25	1.95	14	1	11	1	1			100	200
Webster	200,000	40,000	5	12.00								No sale.	No sale.
W. Castleton, *State*	1,000,000	50,000	20	16.00					2			No sale.	No sale.

* Assessment paid.

† These are fully paid stock, not assessable without a vote of the shareholders.

One dollar per share was paid into the *Adventure* Nov. 6, making the true amount of assessments $8 50, according to a recent statement of the Co., and we have altered the table accordingly. $1 per share was paid into the *Isle Royale* Nov. 15, Phœnix, $1, Nov. 17, and National, $1, Nov. 6, all of which are included above.

JOURNAL OF GOLD MINING OPERATIONS.

The following table will show the coinage at the Mint of the United States, Philadelphia, for the seven months of 1854:

GOLD.

	First six months.	July.	Total.
Double eagles,	$9,790,920 00	$908,180 00	$10,699,100 00
Eagles,	365,640 00	92,340 00	457,980 00
Half do.,	333,585 00	. . . .	333,585 00
Quarter do.,	939,695 00	. . . .	939,695 00
Three dollars,	347,634 00	. . . .	347,634 00
Dollars,	783,943 00	. . . .	783,943 00
Total gold,	**$12,561,417 00**	**$1,000,520,00**	**$13,561,937 00**

	SILVER.		
Dollars,	$33,141 00	. . . .	$33,141 00
Half dollars,	1,153,000 00	. . . .	1,153,000 00
Quarters,	2,068,000 00	92,000 00	2,160,000 00
Dimes,	182,000 00	88,000 00	270,000 00
Half dimes,	212,000 00	. . . .	212,000 00
Three cents,	12,000 00	. . . .	12,000 00
Total silver,	$3,660,140 00	$180,000 00	$3,840,140 00
	COPPER.		
Copper,	$31,381 88	$1,018 16	$32,400 04
Gold, sil. and cop.	$16,252,938 88	$1,181,538 00	$17,434,477 04
Gold bars,	9,071,270 74	2,405,011 86	11,477,082 60
Total,	$25,324,209 62	$3,587,350 02	$28,911,289 64
In 1853,	30,707,726 03	5,171,301 56	35,879,027 59
Decrease, 1854,	$5,383,516 41	$1,583,951 54	$6,967,467 95

The whole number of pieces coined in 1854, was 1,404,450, against 3,518,808 the corresponding months of 1853. Of the pieces coined this year, 54,643 were gold, 1,248,000 silver, and 101,816 copper.

The gold bullion deposited in July, was:

From California,	$3,910,000
From other sources,	39,000
Total,	$3,949,000
Silver bullion deposited,	310,000

Annexed is a comparative statement of the deposits of gold dust for the first nine months in 1852, 1853, and 1854:

	1852.	1853.	1854.
January,	$4,161,600	$4,962,097	$4,215,579
February,	3,010,222	3,548,523	2,514,000
March,	3,892,156	7,533,752	3,982,000
April,	3,091,037	4,851,321	3,379,000
May,	4,335,578	4,365,638	3,506,000
June,	6,639,474	4,545,179	4,000,000
July,	4,193,880	3,505,331	3,910,000
August,	2,671,536	4,518,902	2,940,000
September,	4,253,687	3,027,805	2,660,000
Totals,	$36,299,250	$40,853,048	$31,226,579

CALIFORNIA GOLD FIELDS.

The following summary of the work of the Branch Mint for the past six months, has been freely furnished by Dr. Birdsall:

Months.	Coinage.
April,	$49,478
May,	379,509
June,	460,820
July,	528,000
August,	1,052,200
September,	600,000
Total,	$3,070,007

Months.	Value of Bars.
April,	$462,928 04
May,	777,290 41
June,	437,629 02
July,	457,775 10
August,	1,042,511 95
September,	455,518 65
Total,	$3,633,653 17

Value of Coin,	$3,070,007 00
Value of Bars,	3,633,653 17
Total Value,	$6,703,660 17

The amount of work done during the month of September, as will be seen, is short of the month of August. This was owing to a short supply of acids, caused by a breakage at the acid factory, over which the Superintendent had no control.

CALIFORNIA PROSPECTS.

A correspondent of the London Journal thus speaks of the prospects of deep mining in that State.

There appears to be a belief by some, and a misgiving in others, that deep working will prove that auriferous quartz is only superficial. My ideas are respectfully opposed to those of some gentlemen to whom I do not intend personally to refer; but I will treat the matter merely as one of opinion, regarding which every one may state his *pro* or *con*.

If it is a matter of opinion, the question can never be settled until deep shafts have been completed. However, an approximation can be ascertained at present by consulting the concurrent unconnected testimony of such as have inspected the deepest workings. I do not speak of Australian lodes; I have not been in that country. Much unbiased evidence could be adduced by persons now in England who have been engaged in examining mineral properties in California, and in different parts of it, showing that the lodes are not, as a rule, unproductive in ratio to depth.

In some instances the lodes get richer below; in others, poorer. In others, again, a rich deposit at surface has induced unthinking speculators to plant expensive machinery before making a sufficient prospect; and the lode on being gone into has proved of a bad character, and has ruined the adventurers—the precautionary preliminaries being postponed, which would have ascertained not merely the character of one lode, but the whole mineral contents of the property; and then, with reckless haste, inefficiently completed, driving in a wrong direction, for the sake of arriving by the shortest cut at the lode which could be seen cropping out, when, by driving a longer cross-course at right angles with the lode, other valuable lodes might have been found. The lodes which do not crop out are, I will show hereafter, likely to prove the best.

Deep mining, in the English sense, is not yet necessary; and it will b many years before a 200 fm. shaft exists in California. The results are, on the average, not discouraging at 10 or 12 fms. from the outcrop perpendicularly. As stated above, the ores varying from poor to rich, as well as from rich to poor, 2 cwts. of ore cannot be taken out of any mine, each cwt. being exactly similar. This is not advanced as a new truth, but it has been so long known to be true of all mines, that people seem to have forgotten it.

No lode well defined at surface has, as far as I could ascertain, given indications either of "giving out" or of being dislocated by fault; in fact, the lodes appear to be remarkably regular both in direction and dimensions—in direction collectively, and in dimensions separately. However, there may be many unexplored exceptions to both the former and the latter, which are, however, general rules.

THE MILLS OF GRASS VALLEY.

We are indebted to the *Grass Valley Telegraph* for the following interesting details respecting the Quartz Mills in that region. It is introduced as follows:

In treating of the subject matter, denoted by the above, we have to plead to our readers some excuse, which cannot perhaps be expressed by any other word so fully as ignorance. We regard the quartz mining of California as its greatest interest. It is to Nevada County what the manufacturing interest is to inland towns in our own New England. That this will in its proper time be fully known, we have not the least doubt, and for this reason we give the following solicited account of the several mills. We should have been pleased to publish the history of all, but we have only received what we now lay before our readers.

Manhattan Company.—We have received the following letter, which we publish in full, as it is from a gentleman better capable of judging than ourselves:

We, that is to say, myself and some friends, have been in your interesting village for some weeks, enjoying ourselves very much. We have visited the diggings all around, and seen most of the quartz mills. Wherever we went we were well received, and kindly treated by the miners and managers of mills. In our loiterings we dropped in at the Manhattan reduction work, and, as it is different from all the others, works admirably, and is on a good principle, I shall endeavor to describe it.

The grinding part consists of a circular trough of cast iron, twelve feet in diameter; it is in segments, the bottom 12 inches wide, and chilled, the sides 15 inches high. In this trough roll 9 wheels 4 feet diameter, 7 inches wide on face, which is also chilled. These wheels weigh one ton each, make 25 revolutions per minute, and are pressed down by a heavy circular ring with a force amounting to a weight of 12 tons; which force is produced by cylindrical india rubber springs. The whole moves easily and with but little noise. The large pieces of unburned quartz rock subjected to the rollers are immediately crushed and ground up. A constant stream of water runs into the trough, and the finely ground quartz flows from it into ripple boxes very neatly constructed. The ripples are filled with mercury, in which all coarse gold is caught; then the slime passes into a revolving cylindrical fine wire sieve, where all chips and dirt are taken out on one side, and continues its course through another series of ripple boxes, and finally runs through a large kind of Hungarian amalgamating mill, but so perfectly is the gold taken up from the pulverized rock, that, for one dollar's worth produced in the amalgamator, 16 ounces have been taken from the ripple boxes. About 30 tons of hard rock can be reduced daily. The tailings are the finest I have seen from any mill in this district. The whole of the machinery for crushing and grinding, together with the amalgamating apparatus, is most compact and well inclosed. The engine, which gives motion to it all, is 40 horse power, and fully capable of doing double as much work. The establishment is conducted on a most prudent and economical plan, and the reducing and amalgamating of the ore does not exceed two dollars per ton.

Helvetia and Lafayette Gold Mining Co.—The Helvetia and Lafayette Gold Mining Co. was formed, April, 1852. E. R. Baxter was elected President of the Company. The mining property consisted of Lafayette Hill, near the village of Grass Valley, comprising an area of twelve claims of eighty feet each, making 960 feet in length. The vein was originally discovered by a party of Frenchmen, and taken up and worked by them, until a few Americans bought out most of them. There was no particular indication on the surface of a quartz vein being there, and the ground had been travelled over almost daily for two years. A small piece of quartz was picked up on the surface, which was rich with gold, causing them to dig down for a vein, which they soon struck, as it was not far from the surface, and proved to be quite rich. The claims were duly taken and recorded, and work commenced on them, and several hundred tons of rock taken out, almost all showing gold. Six elevenths of the interest were sold to Messrs. Baxter & Hollis and Dr. Bacon for eighty thousand dollars. From the 11th of April to August 11th, 1852, there was taken out something over ninety-eight thousand dollars, and

the net proceeds, after paying for hauling, crushing, quarrying, sinking shafts and running tunnels, was over fifty thousand dollars.

August 11th, 1852, Messrs. Conway & Preston's mill, with two batteries, of nine stamps each, weighing each 950 lbs., and an engine of 25 horse power, with a large number of claims on Gold and Massachusetts Hills, were added to the property of the Helvetia & Lafayette G. M. Co. From the 11th August, 1852, to Dec. 1st, 1853, there was taken out in gold $84,200. This time includes the last winter, when the mining operations were suspended several months on account of bad weather and water in the mines. A large portion of the receipts were expended in permanent improvements in the mines, mill, &c. Had not that have been the case, there would have been good dividends paid to the stockholders.

The Lafayette Hill vein runs through the hill in a northeast and southeast direction, with a dip of about forty degrees to the east, and from two to three feet in thickness, and encased in greenstone rock, which increases the expense of taking out, as it has to be done by blasting. The vein is very uniform and regular, yielding very evenly. The upper part of the vein, to the depth of about twenty-five was very rich, and at thirty-five feet poorer than it now is at the depth of forty and fifty feet, and the evidences are that it will still grow better as it is worked down. The rock is very hard, and of a different character from that on Gold and Massachusetts Hills, containing large quantities of sulphuret of iron. The cost of quarrying it last year, after getting into the greenstone, was from $12 to $14 a ton. This year it has cost but from $7 to $8 per ton. Almost the same difference in expense has been made in running the mill by the decrease in the price of labor and materials. On Gold Hill and Massachusetts Hill, the cost of taking out the ore has been about $5 a ton this season.

The mill, when both batteries are running, is capable of crushing from forty to forty-five tons per day. But one battery has been running at a time, as it has been thought that it would be more profitable not to mine any more than one would crush at present, as the prospect was that the business could be carried on much cheaper each coming year, for some time to come.

The actual cost of crushing has been, including all expense, superintendency, wear and tear, &c., about $5 per ton. Nearly all the rock has been burned, which causes it to pulverize more easily. The original process of amalgamating at the mill of this company, was by shaking tables alone; then blankets were used in connection. Now the process is, the pulverized material passes over three long blankets first, then through Cram's cylinder amalgamator, thence over three ripples with quicksilver in them, thence over two of Berdan's crushers and amalgamators, thence through a long sluice. An additional amalgamator is about being put in, consisting of a tub and stirrer, with about 100 lbs. quicksilver in it. About fifteen per cent. of the gold is obtained in the Berdan mills that formerly was lost.

The improvements made in amalgamating and the reduction in expenses have much increased the profits of the business. There is a large quantity of gold in the iron, that cannot be saved, or is not by the present mode of operation, and I have no doubt that when it is, will nearly pay all expenses. It is customary here to run the mills day and night, which is considered to be more profitable than to run only during the day.

It is reduced to an absolute certainty that rock paying fifteen and twenty dollars a ton, where the vein is of a fair thickness can be worked to great profit. The rock of this company often produces $30, $40, $50, and even $80 per ton.

Empire Company.—In compliance with your request, I herewith submit to you a few of the statistics of the Empire Mining Company, trusting that the same may induce a greater degree of confidence in the operations of quartz mining, and may at least modify the distrust which has hitherto attached to that department of mining. The limited space allowed me in your paper, will not admit of my saying any thing in reference to the profits that might

accrue from that branch of mining, with a judicious use of capital, and when all the conditions now known to be necessary to the conduct of that business, are complied with. I will therefore submit to you a few items, and the community may draw its own inferences.

The Empire Mining Company was incorporated on the 4th day of May, 1854, for the purpose of carrying on the business of quartz crushing, in such manner as would best secure the separation of the precious metal from its matrix, and also the business of "sawing of lumber." Without reference to the lumber department, I need not say that in the department of quartz mining, the company have been eminently successful, and have demonstrated that the business, rightly conducted, can be made to yield an immense return upon a comparatively small outlay of capital. The Empire Company have crushed rock from all the principal hills in this vicinity, and have kept an accurate account of the yield of all the rock, thus enabling them to furnish a certain degree of reliable data, as it is made up of the yield of good, bad and indifferent rock.

In four months' time, the Empire Company, running twelve stamps twelve hours to the day, commencing the 22d of August, and ending the 22d of December, 1853, crushed 1,390 tons of rock, the gross yield of which was $57,310 47, or an average of a trifle over $41 per ton. It must be borne in mind that this was taken from every different hill in this vicinity, and among it was some rock that did not yield over $1 per ton. Now, allowing 26 working days to the month, and 12 hours per day running time, the whole number of hours necessary to crush the 1,890 tons of rock, was 1,248, or there was crushed on an average, something over one ton per hour, which yielded over $40 per ton. The whole cost of raising, hauling, and crushing said rock was about $19 per ton, leaving a net profit of $27 per ton, or from the 1,390 tons, there was a net profit of $47,530. Then assuming that $50,000 would have purchased every ledge from which said rock was crushed, and would have built a mill suitable for reducing the same (the estimate is greater than the cost of the case), in four months' time there would have been a return of about 90 per cent. upon the investment, or above 20 per cent. per day, and I am well assured from over two years' experience in the business, that under even fair circumstances the same result might be constantly realized. I will here mention that the Empire Mining Company, having been engaged in the business for over two years, have recently felt themselves justified in going to the expense of erecting extension works upon their hill, Mount Ophir, for the purpose of draining the ledges in the same, feeling assured from their past experience that they will receive an ample reward for the great expense incurred in endeavoring to develope the hidden treasure in said hill.

Gold Hill Company.—This mill is under the joint management of Messrs. Atwood and Walsh. The actual invested capital, is $300,000. The mill is capable of reducing 100 tons of quartz in 24 hours. There has been probably over a half million of money earned at this mill since its erection. The machinery cannot any where be excelled, and possessed of rich leads, and under skilful managers, its future prosperity can easily be predicted.

Mount George Company.—The Mount George, steam, saw, quartz and planing mills, situated on the north branch of Wolf Creek, one mile east of Grass Valley, were erected in the winter of 1851 and 1852, by the "Pacific Gold Mining company." Through bad management and the inexperience of their agents, this company was not very successful, and in the fall of 1852 they sold the entire property to G. R. Morris & Co., who have since disposed of it to the Mt. George Mining and Lumber Company.

This company own several very extensive and valuable mines, among which might be mentioned Tippecanoe, Mt. George, Eureka, Hagan, &c.

The Railroad from the mill to the pinery, is 1½ miles long, with a 6 foot track, on an inclined plane. The timber is unsurpassed by any other in the State, in proof of which, they are making successful shipments of dressed lumber to San Francisco, and the valley cities, at prices fully equalling the best article of Georgia and Eastern pine.

The capacity of the engine is about 60 horse power. Capable of driving two saws, planing mill, and quartz mill.

Grass Valley Gold Mining Company.—Organized July 27, 1851, with a capital ot $100,000,—$60,000 working capital paid in. Building commenced May 1, 1852, main quartz mill, 50 x 80 feet—engine of sixty horse power,—saw-mill attached 24 x 64 feet, running a mulay and a circular saw of a capacity to make 12,000 feet per day. A planing mill and shingle machine attached, together with a powerful lathe for iron turning.

In July, 1852, capital increased to $250,000—of which about $25,000 additional stock was subsequently issued. Quartz machine calculated for 100 tons per day has been purchased, and is in the county, but which has not yet been put in operation. The expenditure thus far reaching about $120,000, and a further sum of $20,000 being required. The buildings and all the appurtenances of this company are of the most permanent and substantial character, the situation, central and if completed upon the plan thus far pursued, no doubt can exist that the company will be highly successful.

Water Companies.—There is matter of the most vital importance to California, upon which much has been said, but nothing as yet accomplished, which, if carried out, would prove of more immense advantage than perhaps any move or action which could be suggested. We refer to subjects so often broached, viz., to render governmental aid, in the bringing water for the supply of the numerous rich hills and placers, now by drought rendered of no use or availability.

We did hope that some action on the part of the late Legislature would have placed this matter upon a favorable footing at once. But wasting their time upon matters of trifling import, this matter of sure and certain use was neglected and forgotten. There is of course no one thing so highly essential to the success of our State as the developing and strengthening her resources. Wherever companies have united for the purposes of fluming and ditching, even though the original expense appeared almost insurmountable, still they have in nearly every case proved, in the end, eminently useful and remunerative. It is a matter which must in the end come up for serious debate and united action. The mining interests must be protected and sustained, and if in order to more completely bring out the resources of the country, it shall be deemed fitting that a direct tax should be levied; we say, let it be done. What would that trifling annoyance amount to, when compared to the benefit which must and would accrue? Let governmental action be in some way taken upon that matter, and we care not how, so that the object shall be accomplished, and water become extensively introduced all among the dry, gold concealing hills and placers. We will recur to this important matter more fully at another time.—*Placer Times.*

GEOLOGY OF GOLD.

We have before us a copy of the *Democratic Transcript* (Canton, Ohio), dated the 22d ult., containg an illustrated paper of Prof. J. Brainard, on the origin of the quartz pebbles of the sandstone conglomerate, in which he opposes the old theory, and adopts a peculiar one. The opinion of geologists respecting the origin of quartz pebbles, is, that they have been formed by the action of water, frosts, &c., upon rocks, separating them first into small fragments, then rounding them by a rubbing action upon one another. The theory of Professor Brainard is, that "the sand rocks of the Devonian system have been formed from a solution of silicious matter in the waters of the primitive ocean, and that the grains of sand have suffered little or no disturbance except upon shoals, the beach of the ocean, or in streams of running water." This theory is supported by a great deal of plausibility by engravings, showing layers of these pebbles in an apparently undisturbed position. The theory then amounts to this, that at one time by internal heat the silicious matter which formed these pebbles was reduced to a fluid state, and became

pebble crystals at the bottom of the ocean. It is difficult for us to conceive how fluid silex could be formed into pebbles at the bottom of the ocean; but we have merely presented the pebble theory as an introduction of some interest to two more important geological questions.

In this paper Prof. Brainard says, "there is no controversy among geologists in regard to the antiquity of the granite rock. It is the oldest formation found in the earth's crust, and underlies all others. It has furnished material in combination with oxygen, carbonic acid, and other gases, for all the stratified series." This opinion respecting the oldest primitive formation is very generally entertained, and has been set forth in elementary works on geology. We have evidence before us to show that it is not correct. Prof. Hall, of Albany, N. Y., has said "all the granites of New England were made up from the destruction of the earlier stratified rocks—including those of the fossiliferous period." At the meeting of the British Association, which was held in Belfast, Ireland, in 1851, Prof. Donovan asserted that "the granite was not the oldest formation, that it was underlaid by greenstone in various parts of Ireland." This was disputed at the time, but information from California corroborates his opinions. In the *Mining Magazine* for last month—an able periodical—there is a paper on the Mineral District of Central California, by Prof. J. Trask, in which he says. "thus far the granite series has not been found to exceed a depth of but little more than one hundred feet. Immediately below the granite the greenstone is found underlaying this entire section of country." This for the present settles the disputed granite question, and brings us to another controverted geological question, viz., the position of gold veins, and their origin.

The opinion held heretofore respecting the origin of gold, was that it belonged to the more recent formations, and that gold quartz veins depreciated as they descended from the surface. Sir Roderick Murchison says, "the chief quantities of gold, including all the considerable lumps, have been broken up by denudation, and transported from the mountain-tops into the adjacent valleys." He also thinks that the rocks were impregnated with it at a comparatively recent period—"a short time before the epoch when the powerful denudations took place, which destroyed the large extinct mammalia." Humboldt is of the opinion that the formation of gold had some closer relation to the atmosphere than lead, copper, or iron, and Dr. Percy is disposed to believe that it was once held in solution in an aqueous medium, and thrown down by deposition. These opinions of eminent geologists respecting the comparatively recent formation of gold, have led their authors to assert that the gold of California and Australia would soon be gathered up, and that it would not be profitable to mine deeply for it, as the gold quartz veins would become barren in proportion as they descend. These opinions Prof. Trask asserts in his paper are not applicable to California—that the gold quartz veins become richer as they are penetrated downwards. He says, "in every instance where the granite has been perforated, the greenstone rock has been found beneath, and in every mine throughout the northern districts, in which the greenstone has been reached, the veins (gold quartz) have penetrated this rock, and in *no one* instance is it found that the vein is either pinched or faulted, but the reverse is true, that every set has increased in power *the deeper they descend*. Of six companies now in successful operation in Grass Valley, all of them are obtaining their ores from the greenstone in larger quantity and better quality than was found to be the average in the granite above." Here then is testimony against the theory of Sir Roderick Murchison, Humboldt and others, respecting gold veins coming from above, and which goes to prove that they come from below.

This we consider is one of the most important questions of the age, respecting the geology of the gold formations. If, according to Prof. Trask, it be true that the gold quartz veins become richer as they are penetrated, it is confirmatory evidence of a very old theory respecting the formation and arrangement of the different strata composing the crust of the earth. This

theory supposes that our globe was once in a fluid state, and that as it revolved on its axis, the different substances of which it is composed, arranged themselves according to their specific gravities, the heaviest towards the centre, and the rest like the coats of an onion—the lightest being at the top. Following out this idea, an acquaintance of ours has long held the opinion that if he could but dig deep enough into mother earth, he would certainly arrive at a bed of pure gold. We do not know what effect Prof. Trask's investigations may have upon him, they certainly afford evidence in favor of his notions. At any rate, we have presented this important geological question as it now stands, so that all may understand it. And we hope that all future investigations will lead to the certain gratifying result, that we stand on a foundation of gold, instead of dwelling upon a planet having only a few favored spots here and there of its surface bespangled with this precious metal.—*Scientific American.*

RUSSIAN GOLD MINES.

A work of authority on the manufacturing powers of Russia was published some years ago by a Mr. PRELEZYNSKI, and he made the average annual produce of siver 43,200 lbs., and of lead 1,440,000 lbs. The aggregate produce of copper, both from the Government and from private mines, he returned at 7,596,000 lbs. All the gold raised at the Ural mountains is coined in the country, and he makes the quantity extracted from the Ural mines, and coined, in the ten years intervening between 1824 and 1834, 117,564 lbs., and the value, 7,143,499*l.* Platinum is also found in Russia, and is likewise coined into money, and we are told that of this rare metal there were extracted from the Ural mines, and coined, within the same years, 28,125 lbs., value 393,737*l.*

The Russian measure, the pood, is about 36 lbs. avoirdupois, and the gold produce of Russia in 1846 was—private mining, 1490 poods; public mining, 187=1677 poods. The total quantity obtained in 1847 was 1779 poods. The produce in the ten years, 1837—46, was 8387 poods of fine gold, amounting to 366,848 lbs., value 18,751,310*l.* The produce of platinum in 1843 was 213 poods=7668 lbs., and the quantity of silver obtained in 1847 was 1190 poods.

Sir RODERICK MURCHISON had, early in the summer of 1840, visited the gold regions of Siberia, and, in a paper read before the Geological Society of London in 1844, stated the entire gold produce of the Russian empire to be then nearly three millions sterling. The very elaborate work published by him and his colleagues, MM. DE VERNEIUL and Count KEYSERLING, appeared in 1845; and it may, perhaps, be fairly assumed, that since they geologically surveyed the Ural Mountain district, the produce has not been stationary, but has rather advanced.

GUSTAVUS ROSE, a German writer, published at Berlin, in 1837, an account of the gold workings of the Russians in the Uralian district, and states that the auriferous sand principally occurs on the eastern declivity of the range. The sand from which the gold is at present extracted contains from about 1-2280 to 1-1920 part, and the expenses of washing and extracting commonly amount to two fifths of the net produce. According to Mr. ROSE, sand is sometimes found in which 1-600 part, or even 1-300 part, proves to be gold, and it is his opinion that, under good management, sand containing only 1-7680 part of gold could be washed with a fair prospect of profit. It does not appear that any efforts have been made to procure gold by crushing, or by ny of the improved processes which the superior intelligence and activity of the Anglo-Saxon race have recently introduced. The platinum mines are situated on the western declivity of the Ural Mountains, and the proportion of that metal is stated to be very much larger than that of gold, amounting on an average to 142 part of the whole mass. Pieces of pure platinum have been sometimes found, weighing several ounces, and even, in some instances, over

a pound. A small quantity of gold is sometimes united with platinum, and platinum has been itself discovered between layers of serpentine.

The gold mining system of Russia is thus described by a recent writer, Mr. COTTRELL, and it would appear to be rather a fair and reasonable one. Every freeman in Russia, not being a Government *Employé*, is at liberty to search for gold; and if an explorer be successful, he announces the fact to the Government, and applies for permission to avail himself of the discovery. A mining officer is then sent to examine the spot, and to mark out a district of about two English square miles, of which the explorer is put into possession, so far as regards gold searching. The speculator is then at liberty to build huts, and to hire and locate laborers in them, who are generally persons who had been exiled to Siberia. At the fall of the year, when the intense cold impedes further operations, the gold procured is taken to a Government office in the nearest town, where it is weighed, registered, melted, moulded into ingots, assayed, and accurately valued—the ingots are then transmitted to St. Petersburg, and coined into money, which is paid to the speculator, the authorities deducting a small per centage for the purposes of the State. The Government is anxious to encourage such enterprises, and does not, therefore, press very heavily upon the adventurers. The returns are, however, precarious, and our author records one instance where a speculator in gold expended 35,000 roubles out of 40,000 of borrowed money, before any fruits resulted—but fortune then showered so bountifully upon him, that in the course of a few years he became a millionaire.

REFINING GOLD.

The gold is melted with three parts of silver, and, when in a melted state, is thrown into cold water. This has the effect of dividing the metal into small flakes, which are thrown into glass matrices and treated with nitric acid, which dissolves the silver and leaves the gold untouched. The gold, after this process, is taken from the matrices, and collected in a large copper pan or other vessel. Any one to look at it, so far from taking it to be refined gold, would imagine it was a collection of worthless brown sand. It is then washed and dried, and afterwards put into a crucible, re-melted and cast into bars of fine gold.

The liquid into which the gold was put for the purposes of disengaging the silver, and which it holds in solution, is taken and thrown into a large vat containing salt and water. The mixture is kept in a continual state of agitation. The silver, by this means, is precipitated as an insolvent chloride.

This white chloride is washed thoroughly in warm water, it is then put into a proper vessel and mixed with granulated zinc. Under violent ebullition for some time, the nitrogen gas is disengaged and the silver left pure. The chloride having a greater affinity for zinc than silver, unites with the zinc and forms a chloride of zinc.

JOURNAL OF COPPER MINING OPERATIONS.

The reports from the different copper mining regions of the country represent a very active and promising condition of operation. In the distant regions of Lake Superior and Tennessee, great enterprise is displayed, while near our market, in Connecticut and Vermont, the prospect is quite encouraging.

LAKE SUPERIOR MINES.

We shall chiefly confine our notice of the Lake Superior Mines, at this time, to the brief reports relative to their present condition, reserving for future occasions, more extended observations of each one. In this object we are greatly indebted to our friend and correspondent, J. M. Bradford, who is the enterprising editor of the "Mining News," a new periodical at Ontonagon.

Rockland Mine.—This mine is situated on a location until recently known as the Lake Superior Mine, the old charter of that company having been purchased by them.

In September, 1853, a large and rich lode was opened here, which appeared to be identical in course and character with the Minnesota vein.

The Company own 480 acres, and upon this tract they claim that they have both the Minnesota and National veins.

They are driving an adit that they intend shall intersect both veins in its course.

They have on their location three or four dwelling-houses, a boarding-house and blacksmith shop.

They have shipped this season 25 tons of copper in mass and barrel work. At the present price of copper, this quantity will pay two thirds of the call upon the stockholders for assessments, which has been but $15,000. At the same time the mine has been advanced by making new openings under ground, and by surface improvements. A force of 80 men are now accommodated and worked during this winter.

Flint Steel Mining Co.—This mine has a large amount of work laid out for winter operations, in the way of opening new ground.

Their first level is to be connected with shafts Nos. 1 and 2.

Their second level they are now sinking their shafts to meet, and when met will open a large amount of stoping ground for producing mass and barrel work, and about 8,000 lbs. of copper has been produced within a short space of time, all ready for shipment.

Windsor Mine.—There are about 40 men employed here, of which 26 are miners.

Six men are engaged in driving up the adit which is now driven about 430 feet.

New England Mine.—This mine was started this season. The stock is divided into 20,000 shares, and is principally held in Boston. The subscription price was $1,50.

The location is on the southern metalliferous range, on or near the lake shore, and comprises fractional parts of Sections 20, 29, and 30; T. 58 north; range 27 west.

The location was formerly owned by the "Keystone Mining Co.;" who did some little work, but abandoned it for want of means to carry it on.

The company commenced work in May last, under the superintendence of Mr. EDWARD TAYLOR, who has employed some 8 hands in a thorough system of exploration, and has opened several small veins; but enough is not yet known of them to warrant working them. He however has discovered one, of from 12 to 15 inches in width, composed of prehnite, quartz, and chloride, with fine copper mixed through the stone, and which looks well. The company intend working this vein in the spring. There are three good dwellings, a blacksmith shop, and magazine.

Keweenaw Mine.—The location was formerly owned by the "Lac-la-Belle Mining Company," but was disposed of by them to the present company of English capitalists, who commenced work in November last, with Capt. John Hoar, as agent. A large force was worked until about 3 months since, when the state of the money market caused a reduction in the number of men to 6 miners and three surface men, the force worked at present.

Capt. Hoar thinks that a much larger force will be employed before the winter sets in. The location is in T. 58 north; range 28 west. That part of the location that the mine is on, is a portion of Sec. 13; situated two miles north of the New England, and on the south range also. There are two veins open to some extent. On the west vein a shaft has been sunk to the depth of 55 feet, and an adit driven 90 feet. The vein looked pretty well, averaging two feet in width, from the face to the mouth of the adit. About 500 feet east of these workings is the vein on which work is now being prosecuted. No. 1 shaft has been sunk 54 feet, and No. 3 shaft 127 feet.

At the depth of 60 feet in No. 3 shaft, a level was driven north 158, and south 75 feet. The vein in this level is from 2 to 3 feet wide, and well charged with copper. The shaft (No. 3,) being intended for the working shaft, has been sunk perpendicularly, and the vein pitching to the east. A cross-cut has been driven 20 feet east, to cut the vein. Where the vein was intersected by the cross-cut a week since, it was two and a half feet wide, though a good deal disordered. There are some six dwelling houses on the location—two frame and four log ones; there is besides, a blacksmith shop, barn, magazine, &c.

Clarke Mine.—The first work at this mine was done early last winter. A small force has been worked most of the season, but no miners are employed at present. The agent, Walter A. Northrop, says mining operations will commence in a few days. The company own 1000 acres of land. The mine is on the north of the northeast quarter of Section 9; T. 58 north; range 28 west. From the shaft, which has been sunk 30 feet, and the adit 150 feet in length, several hundred pounds of mass copper has been taken. The vein is somewhat irregular. A mill has lately been erected, to which it is intended to attach stamps in the spring. The number of surface hands employed in working the mill, clearing land, &c., is 16.

The Empire Mine.—On the North Range, five miles in a southwesterly direction from Copper Harbor, and is on the north half of Section 11; T. 58 north, range 29 west. Besides this half Section, the Company own 300 acres immediately adjoining.

The shaft which is being sunk is now some 70 feet deep. The vein has averaged 16 inches in width from the time of starting, and has been heavily charged with copper, stamp and barrel work.

The agent, E. C. Hungerford, says that the mine will work the same force which is employed at present, 4 miners and 3 laborers. The vein is the same on which the "Iron City Company" have been working of late.

The Star Mine.—Capt. James Everington, agent, is on the South Range, in T. 58 north; range 28 west; parts of Sections 9 and 10, comprising 560 acres.

No. 1 shaft is now 70 feet deep; No. 2, 88 feet deep. The top adit is 827 feet in length; bottom adit 600 feet. Winze A is sunk 40 feet from the top adit. Winze B, from the bottom adit, 62 feet. 10 miners are employed in sinking No. 1 shaft, and driving the bottom adit. The vein is the best looking one in this section of the country; the average width being 3 feet, and yielding a quantity of stamp and barrel work.

There is six acres of land cleared, which yielded a good crop this season. There are eight good but small dwelling-houses, a blacksmith shop and barn.

Clinton Mine.—The location upon which this mine is situated contains 320 acres, and is situated about midway between the Derby and Sharon mines; surface operations were commenced here about the first of July last. A dwelling-house, warehouse, and other necessary buildings preparatory to opening the mine were constructed. About the first of October last the work of opening the mine was commenced. The vein on which the shaft is sinking is thought to be the south vein of the Sharon.

There are only six men now employed.

Gogebec Mine.—This location was commenced a little more than a year since, employing a force of 20 men. The yield of the vein in this mine is

similar to that of the Magnetic, being small masses, barrel work and stamp work.

This location is one and a half miles east of the head of Gogebec Lake; a beautiful spot, at least, for a summer residence.

Ridge Mine.—This mine is situated three fourths of a mile from the terminus of the Ontonagon Plank Road, and it is designed to build during the coming summer, a plank road to meet that road.

Two shafts have been sunk here, one called the Clark shaft, to the depth of 360 feet, and the other the Hanna shaft, to the depth of 340 feet. During the month ending at this date, the former shaft was sunk 10 feet, and the total amount of stoping was 180 cubic feet.

A force of 70 men is at work, and a steam-engine of 34 horse-power, which drives a saw-mill and 12 head of stamps.

A new engine has been built and forwarded from Pittsburgh, which will be used for pumping water and raising copper.

There are thirty-five acres of cleared land upon which are raised this year, hay, oats, potatoes, and turnips. Eight dwelling-houses have been built.

Metropolitan Mine.—This mine was commenced during the past spring, and a vein was found and opened that was thought to be equal to any in this country in rich stamp work taken from the surface. The surface improvements were commenced at the time that the vein was opened.

The location contains 3000 acres of land. At this time 12 men are employed, and that force will be increased as soon as buildings can be completed to accommodate them.

Nebraska Mine.—This mine has 10 acres under cultivation, and three houses constructed, two plank houses and one log house. Efficient operations were commenced at this mine about the 1st of July, 1854. A level has been driven at the foot of the bluff, on the course of the vein, 46 feet 5 inches, on the 1st of Sept. There have been 3 fathoms of ground stoped, up to the same date, and 6½ tons of mass and barrel copper have been taken and made available for shipping, from the ground opened—and 27 tons of rich stamp work. There has also been other barrel work taken out of the ground, which has not been prepared for shipping.

A shaft was commenced the 13th inst., and is now progressing, from which there has been taken 1½ ton of mass copper at a depth of six feet; and a well defined vein continues.

A new adit has been commenced on the course of the vein, west from the shaft, in which the vein appears to be well defined. There are six or seven tons of copper ready for shipment.

Adventure Mine.—This mine has recently struck upon a new vein of great promise, on the north side of their bluff, from which they have taken 27 barrels of copper, and one half ton of stamp copper, equal to about 15,000 pounds, in one month with only three men.

Magnetic Mine.—This location has 25 acres of land cleared, and good surface improvements generally. Operations were commenced here about one year ago. The vein that has been worked is about 2½ feet wide, producing large barrel work and stamp work. Some small masses have been found here. A force of 20 men are employed.

The Evergreen Bluff Mining Co.—The whole amount expended by the Company is $6,000, and for this the Company have, besides the outfit, tools and supplies now at the mine, a good and commodious house erected, 10 acres of land cleared and under cultivation, producing vegetables sufficient to supply the force employed; an adit 120 feet 8 inches in length, and a shaft commenced, and about 2 tons of copper at the smelting works in Detroit, to be smelted.

West Minnesota.—The vein on this location was discovered by Mr. Merryweather, who thought that it was a continuation of the Minnesota. It is situated immediately on the west side of the Ontonagon River, on the course of the Minnesota Range, and occupies the northeast quarter of Section 19; Township 50, and Range 39.

A Company has been organized and the work commenced this fall under the charge of S. H. Broughton, Esq., late of the Bluff Mine on Keweenaw Point.

Cambrian Mining Co.—It is a location that has not yet been worked, but by the best information to be obtained, is worthy of a trial.

A gang of men has been engaged, and are now leaving here to commence operations on the location.

This location has been examined by numerous gentlemen of practical knowledge in mining on Lake Superior, and they advise trying it.

It certainly has great advantages over most locations on account of its abundant and convenient water power, which is so situated that it can be applied to doing all the work required at the location, being only two and a half miles from the lake.

Merryweather Mine.—This is the most western location on the mineral range that has been opened. It was pre-empted by Algernon Merryweather, Esq., and when the company was organized it was named in compliment to the pre-empter. A vein was discovered upon it 8 feet wide.

Explorations only have been made upon it. The difficulties attendant upon the transportation of supplies and necessaries for carrying on the operation, have alone prevented the opening of the mine.

Upon the completion of suitable communications to the mouth of the Ontonagon, operations will be commenced here. It has 640 acres of land, 1½ miles west of Gogebec lake.

What Cheer Mining Co.—The What Cheer Mining Company is organized under the general Mining Law of Michigan and consists of 20,000 shares, 8000 shares of which were reserved by the Company, for their benefit.

The What Cheer Mining Company's lands were explored about a year ago, under the superintendence of Mr. Coulter, the able superintendent of the Douglass Houghton Mines, and have five regular veins.

The land is located as follows: containing the South half of Section 16, Town 51, North of range 37 West, in the upper Peninsula of Michigan. The tract is situated 8½ miles South and 14 miles East of the mouth of the Ontonagon River, Lake Superior. The main Metalliferous portion of the trap range runs through the tract in two elevated ridges, bearing north-easterly and south-westerly about 30°. The veins run with the formation or ridges across the tract. Vein No. 1, resting upon the conglomerate belt at the foot of the east ridge, has not been uncovered. Vein No. 2, which outcrops 50 feet upon the bluff has been uncovered at several points. It is two feet wide, and is composed of Quartz, Spar, Laumonite and other silicious matter, and metallic Copper. Vein No. 8 is about 45 feet higher up the bluff, and running parallel with vein No. 2; it is also two feet in width and is composed of Chloride, Spar, Quartz, Prehnite and metallic copper, and has been uncovered at points through the entire extent of the tract.

The veins are of the same character, and have the same position in the range as the veins of the Douglass Houghton, the Toltec, National, and the celebrated Minnesota Mine. The veins are all regular and well defined between walls, and appear at the surface to be equal in thickness to the best veins on Lake Superior.

On the west ridge a large Epidote and Quartz vein has been uncovered. This vein opens rich in Copper on the Indiana Mine, and cannot fail to be the same on this. "We have uncovered and examined these veins at different points. The veins of the East ridge are the same which the Douglass Houghton Mining Company are successfully working, adjoining the What Cheer on the north-east, and which the Indiana Mining Company are working upon, adjoining on the south-west."

"The Indiana Mining Company have the best surface show, acknowledged by all who have seen it, on Lake Superior. The vein is over two feet thick, and full of barrel work. At one place there is a mass of copper exposed, of over three feet long, and will weigh several hundred pounds."

"At the Indiana we have one of the most brilliant surface shows ever opened in this country. The vein is large and well defined, and exceedingly rich in copper, and is creating a great deal of excitement throughout Ontonagon district."

There is also another vein on the west part of the What Cheer, from which good specimens of native copper have been taken, where the vein crosses the stream. The land is well timbered, and there are several streams suitable for washing ore.

Phoenix Mine.—A letter from the superintendent says:—"I have the pleasure of informing you that the prospects of the mine are indeed flattering. We have thirty miners at work in all. Six are upon the south side of the bluff, in the east adit, where we have discovered a vein, and although it is not as wide as the vein in the west adit, yet it promises much better. It is well defined and *thoroughly charged with copper*. We have six men in the adit north side of the bluff, drifting for the vein near the foot of the bluff. In No. 6 shaft, we have one set sinking second lift, and the lode as we go down improves in width, appearance and wealth; also both the north and south levels look well, and we are preparing to sink No. 7 shaft, which has become necessary for ventilation as well as to open the mine. The produce of the farm has been secured in good condition, and the crops have been remarkably good. We are pushing the work and are ready for the winter campaign, of which we hope to give, by next spring, a good account."

Algomah Mine.—From this mine, Mr. Sales, the superintendent, writes:—"We are sinking two shafts on the Algomah Mine, the vein is from two to three feet in thickness, and rich in stamp and barrel copper. We have built a large boarding-house which will accommodate forty men. All my crops are taken care of. We raised 600 bushels of potatoes and 200 of turnips. I have commenced exploring at the end of the bluff for the vein for some time since, but the surface is forty or fifty feet in depth, and it has been so wet that it has been almost impossible to sink in the surface, unless you make a tight box. We have four shafts down nearly seventy-five feet. I shall go east and commence two more shafts between No. 4 and the mouth of the adit. I shall commence exploring again at the end of the bluff for the vein, and as soon as I find it, shall commence the adit level, which is the first work to be done. I shall want to work twelve miners this winter, four in the adit and four in each shaft. By next spring we shall have six shafts down."

Forest Mine.—The mine is looking very well indeed, but the bulk of the lode consists of stamp work, and though there is some large piles of it ready, it is not at present in a condition to realize from. The agent writes, "our lode yielding but a small portion of mass and barrel copper to the stamp stuff, we cannot be expected to make large shipments of the former descriptions of ore, but we *can* ship goodly amounts of stamp ore as soon as we get into a position to manufacture it, without stoppages incidental to a new stamping mill. I have not the least doubt, but what we can get over 100 tons ready early in the spring. By that time a large portion of the new works the west end of the mine will be ready for stoping, and then we shall have to erect additional stamps to manufacture the material, and thereby increase our monthly yield very materially."

Dana Mine.—A letter from Mr. Hill, says:—"We now have the 'Owl Creek' vein of the Copper Falls location, opened within 200 feet of the *Dana* land on the line of the vein. It is fully four feet wide, and full of fine copper. Some pieces of pure copper were found on the back of the vein, one of which will weigh seventy pounds."

Winthrop's Mine.—In a letter, Mr. Cox, the agent, writes as follows:—"The vein as far as opened is two feet in width, good walls, and the vein matter well filled with stamp work of excellent quality. The main vein, I am inclined to think, lies a short distance farther east, but the ground being favorable, I deem it expedient to drive a little farther, and, then cross-cut when both veins can be seen in the same geological position, and the expense will

be trifling. Should the vein continue to improve towards the bluff, I shall sink the shaft eighty feet, which will prove the ground to the south. The force to be employed will be as follows: until the middle of November, four miners, one wheeler; after that time the miners and two windlass men, will be the proper force to work, at present. On the surface, from the first of November, I shall require one teamster, and one laborer to get a few logs to the mill, and have them sawed into various kinds of lumber, for use next summer, and also haul the supplies from the harbor to the mine, which will require two months and a half."

The Ohio Trap Rock Mining Company have shipped this summer 89 bbls., net 59,846 lbs., and 2 masses net 400 lbs., all of which has been taken out of the mine since the opening of navigation, and does not include the spring shipments.

Copper shipped from Ontonagon by Spalding & Lockwood.—That reported under Minnesota, includes the Minnesota, Rockland, and Flint Steel Mining Companies.

Copper shipped by Spalding & Lockwood, from May 4th, to Oct. 14th, 1854.

	Barrels.	Masses.	Weight.
Minnesota Mine,	961	666	1,549,706 lbs.
National "	114	61	128,244 "
Forest "	167	6	122,936 "
Ohio Trap Rock Mine,	44		27,522 "
Norwich Mine,	33	29	39,913 "
Windsor "	7	4	4,353 "
Aztec "	6	1	3,000 "
Nebraska "	10	24	15,000 "
Total,	1,842	791	1,890,674

Mining News.

Fulton Mine.—The Report of the officers of this Company, made in September last, present the following facts relative to their mine and property:—

The vein that is now being worked is located in an uplift of trappan cork, in the southern sub-division of Sec. 33, range 32 West, Township 57 North, and extends from the summit northerly; and as yet the limits in this direction have not been ascertained. But should it reach the distance of a mile, it would yet be on the land of the Company.

One shaft, No. 1, has been sunk on the southerly side of the apex of the hill to the depth of 95 feet, and three additional shafts have been sunk on the northerly side respectively of No. 2, 170 feet; No. 3, 120 feet; and No. 4, 80 feet in depth; and two winzes have been sunk from the levels between shafts Nos. 1 and 2 to the extent of 137 feet.

There have been levels run from shaft to shaft at various points, and an adit opened in from the surface at about 100 feet perpendicular below the summit.

This one adit traces the vein over 700 feet, and fully developes its character at that altitude.

It is from these shafts, levels and adit, and the comparatively small amount of stoping that has been done, that the rich masses and other mineral have been taken.

The uplift, at the summit, is about 125 feet above the average level of the section, and terminates at its northerly base in a strip of meadow land.

It is in the direction of this meadow that the vein has been traced.

In order to determine whether the vein continued under and beyond this low ground, the Committee directed the rising ground on the opposite side to be opened, and at the distance of 1000 feet northerly from the shaft No. 4, under the base of the uplift, a shaft was sunk which, at the depth of 61 feet

from the surface, struck the same metal bearing amygdaloid trap, that distinguishes the formation in which the vein has already been found.

This gratifying discovery is now being followed up by cross-cutting, in search of the vein.

The rock taken from this new shaft is of a character, in some respects, superior to that surrounding the present works, as being more yielding and metalliferous. A very short time must suffice, in rock like this, in bringing the vein to view: and when reached will determine its length to the extent of sixteen hundred feet, and with the whole breadth of the Company's land before it for further extension.

The quantity of work done in the mine foots up, in lineal measure, as follows:

Total shafting and wenzing,	663 feet.
" levels and drifts,	1,275 "
	1,938 "

The quantity of stoping has not been as yet accurately measured.

The quality of the metal produced from this mine is equal to any other in the country. The masses have a purity unsurpassed, and are found generally in sizes convenient for handling, although occasional exceptions occur by pieces being of such dimensions as to require cutting up before removal from the mine. In this view the masses may be said to run from 100 lbs. to 4,800 lbs., the latter being the largest mass yet taken out.

The quantity of mineral already shipped is as follows:

Masses,	8,833 lbs.
Barrel work,	12,787 "
	21,620 "

The quantity on the surface of rich stamp work is estimated at 100 tons, and of barrel and masses at 10 tons.

It will be perceived that no stamp work has been shipped, it being deemed advisable to retain it on the ground until machinery be introduced and power applied to a few heads of stamps, would make the metallic per centage marketable; thereby avoiding loss, on unnecessary transportation of the rock.

SURFACE IMPROVEMENTS.

They consist of the three old houses on the location, used as dwellings, and the following new:

Two double dwelling-houses; three single, do.; one warehouse and office attached; one house for mining captain; one root-house; one carpenter's shop; one blacksmith shop; one barn; two coal houses; one whim house; two dwellings built by employees with Company's materials and the shaft houses.

In all eighteen houses, exclusive of the shaft houses, which will have to be increased with the extension of the work.

The buildings are judiciously located, with a proper regard to sanitary precautions, and to prevent the spread of a conflagration.

The force employed has at all times been as large as circumstances would justify.

In fact it has occasionally been found inconveniently large for effective service and consequently reduced, or increased as occasion required. At present there are employed:

20 Miners.
19 { Underground laborers. Surface men.
4 Artificers.

This force is deemed sufficient until such progress is made in ascertaining the principal seat of mineral as will enable the mine to be effectively worked at a point.

EXPENDITURES.

The amount of expenditures from the commencement have been as follows:

Wages, supplies, freights and charges,	$48,586 00
Real estate,	21,000 00
Salaries, office rent and expenses,	3,182 64
	$72,768 64

A portion of these expenses was regarded as too large for any company having no more business to perform than this. And the present direction took immediate means for its reduction, both in salaries and office expenses. Wages and supplies exceeded the amount anticipated, owing to the advance in both during the year.

PROPERTY AT THE MINE.

The Inventory of the Committee, taken during their stay at the mines, exhibits, at a view, the value of the property the company held at that date, and is thus summed up:

Surface improvements, consisting of buildings, roads, cleared lands, &c.,	$6,126 00
Machinery, tools, animals, household furniture, &c.,	1,964 54
Supplies at cost and charges,	5,970 78
Copper on the surface,	3,199 50
Total,	$17,260 82

RESOURCES.

Amount of property at the mine, as set forth above,	$11,134 82
Stock notes,	27,875 00
Cash loaned,	5,500 00
Cash on hand,	1,400 05
Total,	$45,909 87

LIABILITIES.

Bills payable, acceptances,	$5,256 14
Wages, &c., due at the mine,	5,348 21
Due in New York,	616 00
Surplus, personal effects,	34,788 52
	$45,909 87

BOLLY FIELDS COPPER MINES.

The following is the report of Mr. M. F. Stephenson on this property, dated Dahlonega, Sept. 20, 1854:

I have just completed the survey of your property called the "Bolly Fields" Copper Mines, situated seven miles southeast of this place. The vein is on the south side of the rich auriferous belt from which so much gold was obtained in former years. This section is about four miles wide here, and composed of micaceous, talcose, and hornblende slates—alternating with granite and gneiss. It is in the mica and talcose slates where all the rich gold veins are found.

The copper vein now being opened by your Company, is enclosed between hornblende and a mica-talcose slate, the traprock forming the southeast wall or roof of the vein in some places, and being twenty or thirty feet from it in others. It runs parallel with the strata, S. 37°, W. and N. 37°, E. Dip. 70° to the southeast, varying in width from four to forty feet. The ore is the gray or bi-sulphuret, with green carbonate in the underlay, and pockets of black oxide. The gray ore ranges from ten to thirty per cent. The depth of

the *gossan* thirty to seventy feet, which is an immense mass of the red oxide and bi-sulphuret of iron, containing from $3 to even $20 per ton of gold, and some silver. This mine can be drained 392 feet by an adit 1100 feet long to the Chestatee River, through hard mica slate, at a cost of $3000 or $4000, and two years' time,—900 feet will drain the ore 148 feet, and a drain is now being run from the east line 640 feet, principally through digging ground, to the whim shaft (A), which will drain the ore near 30 feet—in pockets at point—of good quality. Several tons have recently been taken out at this shaft worth 20 per cent. From this shaft to shaft 13, 320 feet, the ore rises and the vein becomes formed, the lode increasing from 4 to 15 and 20 feet; and estimating the vein to be only 15 feet wide and an average depth of 40 feet, of ore of that quality,—and from the whim shaft to the west line 1340 feet, it would yield over 20,000 tons, worth over $100 per ton, and it will give the gross sum of $2,000,000. The expenses of mining which and getting it to market will be near $40 a ton, leaving a profit of more than one million of dollars.

The whim shaft A is 83 feet deep, the shaft B is 50 feet, and the shaft C at the summit level is 73 feet, at all of which points the lode is from 4 to 20 feet; and, judging from external indications, the vein is equally good on lots No. 110, 115 and 119, as shown in the map comprising over a mile. No positive opinion can be formed on these lots, as the works have as yet not reached the vein at any point.

As soon as the various openings now made are drained, you will be enabled to raise three hundred tons of ore per month with thirty hands (ten being miners), worth over $30,000; and when you shall have completed your great adit from the river level, you may safely estimate twice that amount.

Monsieur Eugene Gaussoin, a scientific member of the National School of Mines in Paris, is of opinion that the manufacture of sulphuric acid may be made to pay a profit from the vast quantities of bi-sulphuret iron overlaying the copper, and also from the poorer copper ores, which are now rejected, leaving the gold and silver an extra profit, which are now both entirely lost to both the miner and smelter. M. Gaussoin is now corresponding with a company in France, and another in Belgium, on its practicability.

The experiments recently made at Ducktown (Tenn.), in the common section (cold air) blast furnace, to reduce the poor ores to a regulus, has proved a failure; owing, it is said, to the too great excess of alumina in these copper ores.

Timber and water-power are good and abundant on your premises, and a plentiful farming country, equal to all the wants of the miners. The distance to Athens Railroad is 55 miles, Atlanta 70, and Rabun Gap 43.

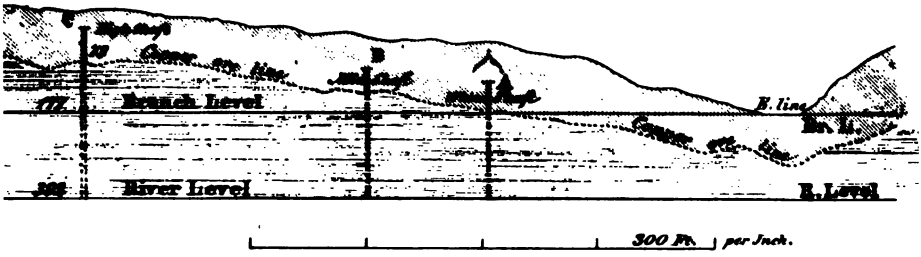
The cost of a railroad from Athens would be one million of dollars for a single track. The cost of hauling 10,000 tons of ore, at $15 per ton, would be $150,000, more than double the interest on the money necessary to build the road, all of which is respectfully submitted.

COPPER IN SOUTHWESTERN VIRGINIA.

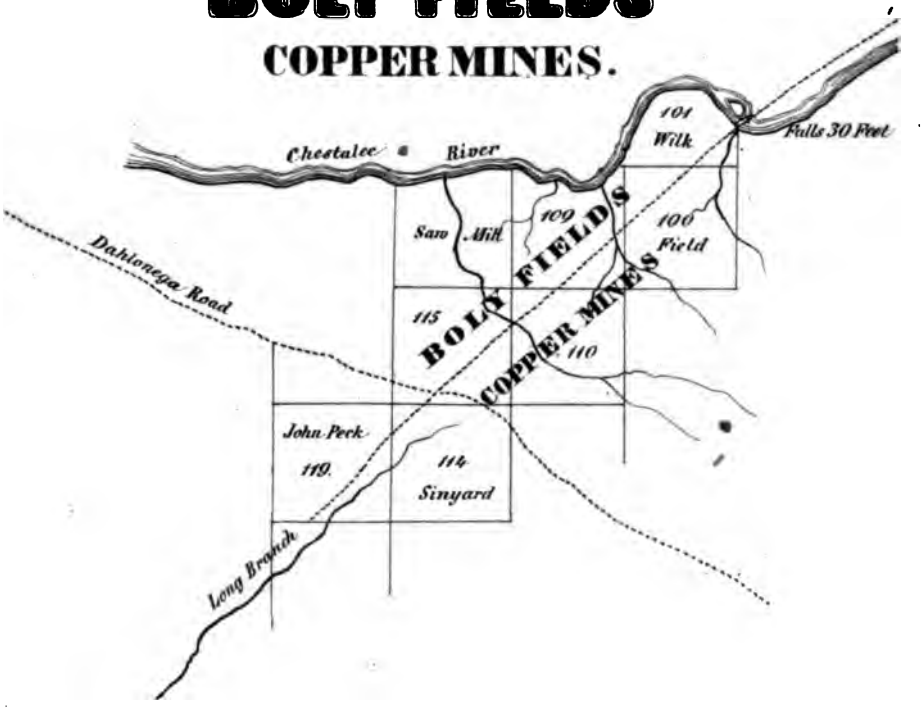
In the region of Floyd county, Virginia, contiguous to the line of the Virginia and Tennessee Railroad, have been lately discovered extended deposits of copper ore. A correspondent of the *Lynchburg Republican* says:

The whole distance through which the copper ore has been traced and shown to exist, with more or less certainty and distinctness, is some forty miles. Its general course corresponds with that of the Blue Ridge. It seems to follow the sinuosities of the mountains, being upon an average of about fourteen miles distant. On this line, copper ore in considerable quantities and of good quality has been discovered. At Carters it is very abundant and of fine quality; and the owners of that property are now putting up buildings and removing mineral. Examinations have also been made, and various

SECTION
of the Lot Nº 109



MAP
of the
BOLY FIELDS
COPPER MINES.



15th Dist.

M.F. Stephenson, Mining Engineer.

th of Snyder, Black & Storm N Y

explorations are in progress at other points on this line—more or less promising in their character.

In no instance, so far as I have learned, has it been necessary to extend the excavations to the depth of forty feet, and nearly all the mineral deposits have been found at much less than that depth. From the formation of the metal, tunnelling is practicable at nearly every point, thus affording the cheapest and most efficient mode of procuring the ore.

Indications of the presence of other metals are not wanting. Mingled with copper in some instances, and separate from it in others, are evidences of the presence of tin, bismuth, zinc, lead, and even silver and gold.

TENNESSEE MINES.

We are informed that three veins or divisions of this metal running parallel with each other the entire extent of this country, promise an abundant supply. These have been recently surveyed by Judge Peck, geologist in the State of Tennessee, and he says there is more copper in the county of Carroll than in any other section of equal extent in the United States.

There are also agents of some two or three mining companies of the State actively employed in taking leases, and the number of leases taken exceed one hundred and fifty in number. We understand Mr. Beauchman of Tennessee, who has taken leases adjoining each other for a distance of nine miles in succession, contemplates commencing work in the course of the next ten days.

Mr. Stuart, on the part of the Ducktown Mining Company (Tenn)., will commence on another lead near Toncray's Furnace, in Floyd County, and work in a westerly direction. The lead is the same as the Ducktown lead in Tennessee, and has been traced from there to the lower end of this county. We learn that Mr. Worth, who commenced work last fall, intends to vigorously press his operations this spring.

The consequence is, that property has steadily and rapidly increased in value; old fields and waste lands have risen from a few dollars to as many thousands. Our merchants are bringing on *drills*, powder, and other necessary implements for exhuming the copper.—*Carroll Mountain Torrent.*

GEORGIA MINES.

While on this subject we would remark that the copper mines of this country bid fair to rival those of our sister State. Ore of a superior quality is now being taken from the mine of Messrs. Moore & Co., for market. The vein at the point opened upon is from thirteen to twenty feet in width; the character of ore gray and bi-sulphuret. A great obstacle or impediment to the speedy development of this mine, is the great quantity of water flowing from the vein, but this evil we learn from the company will be remedied at an early day. They are now preparing to drive a drain tunnel upon the same, which, when completed, will place them at a depth upon the vein of some two hundred and fifty feet or more. The lead is quite prominent for several miles, and several other companies are actively engaged in prosecuting their works, with hopes buoyant with success.—*Dahlonega Signal.*

JOURNAL OF SILVER AND LEAD MINING OPERATIONS.

The quickness with which, in some instances, fortunes have been made in the lead region of Illinois, will scarcely be believed by those not familiar with the facts. As an evidence, take the following instances related by the *Jeffersonian:*—

The suddenness with which fortunes have been acquired in the mines equals the marvellousness of the tales of California or Australia. One or two of an amusing character we will relate:

Several years ago a party of miners were at work not far from Galena, when they were accosted by a verdant specimen of the Coles County tribe, who, with pick and shovel in hand, and plenty of hay-seed in his hair, inquired of them if they knew "a place where he could dig and strike a lead." The day was intensely hot; an August sun poured down his burning rays with such intensity that labor anywhere was almost beyond human endurance. Nevertheless, the unsophisticated nature of the inquiry provoked the waggishness of the mining party to such a degree that they determined to test at least his capability to withstand the melting influence of old Sol.

Directing him by a cowpath to a dense alder thicket, in the centre of which was the dry and baked bed of a spring pond, where the heat was absolutely intolerable, they assured him that there he would find all he desired. With the utmost stretch of good faith in the honesty of their intentions, our friend did as he was bidden, and commenced work on the spot indicated. It was a sweltering place, and his tormentors chuckled as they thought of the funny trick they had played upon a greenhorn; but he persevered; and when about four feet below the surface, he struck upon a chunk of ore several feet in diameter, which was, as exploration progressed, followed by another and another; until after a little time the fortunate finder sold out his diggings and went back the envied possessor of $20,000 in gold, and fitted to be, to the end of his days, a country wayside nabob. It may be supposed that the practical jokers did not soon hear the last of it.

A gentleman now of this city, once commenced with a partner the labor of sinking a shaft on a range where they supposed mineral could be found. They labored with commendable perseverance, drilling and blasting in the tough and pockety rock, until spring; but not the glitter of a particle of ore encouraged them to proceed. At length, tired of their fruitless toil, and disgusted with the place, they abandoned the work. One Sunday in the April following one of the partners strolled from his cabin down to his old diggings, attracted by an idle curiosity to see the hole he had made. When there, he went down by the windlass: but when half way to the bottom, he was met by an obstruction—he could not tell what. Striking a light, he found to his astonishment that the shaft was half full of the richest ore. In working down, they had missed a large deposit of mineral in a conical cavity, by only an inch thickness of rock. The rains of the season had so softened this, that the weight of the ore broke down the thin partition, with the result we have stated. Our friend had, for his share of the pile, just $46,000!

Early in March last Mr. Marsden, well known in this vicinity, after an unsuccessful pursuit of fortune in California, purchased, within three miles of here, a farm of 160 acres for $1,600, with the determination of abandoning mining forever. One day he set about cleaning out a spring, within a few yards of the house on his new place, intending to build a milk house over it for summer use. He had hardly commenced when he had raked up a lump of mineral and then another and another. The search was continued, and to-day the lode that was then discovered is one of the attractions of the mining region, and is valued at $100,000 cash!

SILVER MINES IN SONORA.

Mr. Livingston left San Francisco in February last, on board the bark *Petrita*, bound for Guaymas. His intention was to find, if possible, some mines which he believed were situated in the northern part of Sonora. Soon after the confirmation of the treaty between the United States and Mexico, ceded to us a portion of Sonora, &c., he proceeded as far inland as Alta, where he remained three weeks, thence proceeded to Pitaquitas, 16 miles east of Alta. Here he stopped until the setting in of the rainy season, occupying his time in examining the country in that vicinity, taking with him two of the Indians known as the Papagoes, to guide him to the already discovered gold and silver mines. On the first of July, he extended his search to Sonoita,

where he found Mexicans engaged in grinding quartz and extracting gold therefrom. These had no other than their own simple tools, the *batea*, or wooden bowl, in which to wash, after digging the quartz with a small bar of iron, and crushing it between two stones. By this process, they were making from $2 to $4 per day by the hand. He then continued southward 90 miles to Quiquator, near which he found other parties of natives engaged in a manner similar to those before mentioned. In this part of the country he suffered innumerable hardships, being frequently without water for two or three days at a time, and upon one occasion he would have died from exhaustion in the mountain fastnesses, unattended and unknown, but for some friendly Papagoes, who found him in a helpless condition, and bore him twenty-five miles to where he could get water. Even this did not deter him from the prosecution of his self-imposed task.

He searched and prospected in every direction, and the result is that he has discovered some of the richest deposits of gold and silver ever found in that section of the continent. He discovered a mine of silver, the "blossom" of which extended for three miles, varying from two to five inches in width upon the surface. Although his researches for gold were eminently successful, and he assures us that parties of miners would do a very good business in them, he intends devoting his attention exclusively to the working of the above mentioned silver mine, and for that purpose he returned to San Francisco with a view to the organization of a proper company, to consist of 100 men, well armed, with at least one revolver and rifle each, and the whole to possess a capital of $14,000 with which to purchase the requisite machinery for successful silver mining.—*Alta Californian.*

SEPARATING SILVER FROM LEAD, AND THE PURIFICATION OF TIN.

At the last annual gathering of the Royal Cornwall Polytechnic Society. Mr. J. A. Phillips, of London, at the request of the chairman, addressed to the Society some observations, in which he stated that one of the most important improvements which had recently been made in the metallurgical art came into operation last year, and is the separation of silver from lead by means of zinc. After describing the old process of separation, and the subsequent process discovered by Mr. Pattinson, of Newcastle-on-Tyne, involving several crystallizations and a final cupellation, he stated that still more recently a patent had been taken out by Mr. Parkes for a process by which he separates the silver entirely by one operation. To do this, the alloy of silver and lead is melted in the usual way in a large iron pot. To this a small quantity, a few pounds of zinc per ton, is added, the whole mixed up and allowed to remain a short time. By this means the silver is brought to the surface in the form of alloy with the zinc, and this mixture is subsequently skimmed off and treated for the silver it contains. In order to do this the zinc is first partially separated by oxidation, and the residual alloys afterwards treated in the cupel. In connection with the purification of metals, he might mention some of his own experiments in regard to tin. The tin from Peru and some other countries contains a large amount of tungsten, or wolfram, which very much depreciates its value. Till recently this tin could only be employed for very common purposes, such as making tin pipes and other things, which did not require tin of good quality. But in analyzing some of this tin he happened to discover a process by which the separation was very easily effected, and this process has been recently patented. It consists in taking impure tin, containing from 5 to 10 per cent. of tungsten (worth 25*l.* per ton less than tin of ordinary purity,) granulating it by melting it in a reverberatory furnace, and allowing it to flow in a vessel containing water. This granulated tin is then placed in a pan with common hydrochloric acid, which may be obtained from the soda manufacturers at also a nominal price. This being heated, hydrogen gas is evolved, and a solution of chloride of tin is obtained. In this operation it is necessary the tin should be present in ex-

cess; unless it be so a certain portion of tungsten is dissolved. Should, however, the operation be carried on too far, and a portion of tungsten be dissolved, the addition of a small quantity of impure tin precipitates the tungsten, and chloride of tin, free from tungsten, is obtained. This is turned off into a vat, in which more granulated impure tin is placed, and any arsenic or antimony remaining is there deposited, and a pure solution of chloride of tin is obtained. From this we have to get the chemically pure tin we require, and which is quite as good as the stream tin of Cornwall. Into this bath we put bars of metallic zinc, which precipitate the tin in a spongy mass, when instead of chloride of tin we get chloride of zinc. The tin thus produced may be fused into bars, or sold as the best tin. The chloride of zinc must be used so as to lower the expense of the whole process. To do this it is precipitated by milk of lime, or common chalk; we then get oxyde of zinc, which is largely used as a pigment; and to give it sufficient opaqueness for that purpose, the washed oxyde of zinc is heated to redness, when it is found to be equal to the ordinary oxyde of zinc obtained by sublimation.—*London Mechanics' Magazine.*

COALS AND COLLIERIES.

ANTHRACITE COAL TRADE FOR 1854.

Shipments from Richmond to December 2d, . .	1,314,326	tons
Same time last year, ...	1,088,167	"
Increase, ...	226,159	"
Amount sent by Reading Railroad to November 30th,	1,988,477 16	"
" " Schuylkill Canal, , , . .	896,978 07	"
Total, ...	2,885,456 03	"
To same time last year, ...	2,431,232 00	"
Increase, ...	454,224 03	"
Lehigh coal shipments to November 25th, . . .	1,207,684 10	"
Same time last year, ...	1,018,786 09	"
Increase, ...	188,898 01	

We estimated the quantity sent to market by the Delaware & Hudson and the Pennsylvania Coal Companies, at 950,000 tons—the quantity sent by the Delaware & Hudson Company is 440,944 tons—by the Pennsylvania Company, 496,648 tons, making 937,692 tons for the year, of which from 15 to 20,000 tons are frozen up on the line of the Canal. The Delaware & Hudson Company has fallen 53,264 tons, and the Pennsylvania Canal Company, 32,052 tons—making the deficiency this year 69,316 tons, caused by freshets, which materially damaged the Canal, and low water a portion of the season.

The Delaware & Hudson Company has declared a semi-annual dividend of 6 per cent. on their business for the year.

The quantity sent by the Lehigh last year was 1,080,544 tons. Up to Nov 25th, the shipments from that quarter reached 1,207,684 10 tons—showing a increase of 127,140 tons so far over the whole supply of last year. The Mauch Chunk *Gazette* says: "The trade in this region will soon be brought to a close, although 84,000 tons were shipped after this time last year."

The whole increase this year will not much exceed, if it reaches 175,000 tons from the Lehigh.—*Miner's Jour.*

RATES OF TOLL AND TRANSPORTATION ON RAILROAD, NOV. 9TH.

	From Mount Carbon.	*From S. Haven.*	*From Pt. Clinton.*	*From Auburn.*
To Richmond,	$2 25	$2 20	$1 70	$1 75
To Philadelphia,	2 15	2 10	1 60	1 65

RATES OF TOLL BY CANAL.

From Port Carbon to Philadelphia,	$1 00
" Mount Carbon "	90
" Schuylkill Haven "	97
" Port Clinton "	85

RATES OF FREIGHT BY CANAL.

	Philadelphia.	*New York.*
From Port Carbon,	$1 05	$2 15
" Mount Carbon,	1 05	2 15
" Schuylkill Haven,	1 00	2 10
" Port Clinton,	0 00	0 00

THE EXPORT OF ANTHRACITE.

To the Editor of the Mining Magazine:

Being, I believe, the only person who has experience in the management of coal mines *through* the anthracite district of Wales; having also some knowledge of a great part of the anthracite district of Pennsylvania, I trust I may be excused for offering a sort of review of the question now mooted on both sides of the Atlantic;—that of the "export of Pennsylvania anthracite to London." The party desiring information should have a just idea of what can be done in Britain, before he calculates on sending to London anthracite, certain to be worth, in future, upwards of four dollars per ton in New York. I shall keep in view not only what has appeared in your columns, but also a letter in the London Mining Journal, 10th Sept., 1853. The writer of that letter is not better informed as to what has been done towards the introduction of stoves and anthracite in London than of the cost of anthracite, on board ships, of 1000 tons burden, in a dozen fine harbors of South Wales. The mineral basin of Wales has been compared to a lady's fan in the wind. The length of it along its centre is about 100 miles east to west. Unlike the basins of Pennsylvania, the narrow end of this basin is *westward*, but, as in Pennsylvania, the *north* crop is far more valuable than the south, the inclination being less rapid, &c. The east end of the Welsh basin being upwards of twenty miles wide, with a rise east of about 1 in 10, gives the idea of the "fan." I will endeavor to give the qualities and position by commencing at the rivet of the fan, and following the north crop. We have on the coast of Pembrokeshire, near Milford Haven, the fine "black marble" anthracite, of various thickness of seam, below tide water level—and in terribly costly ground, as to timber required for working. The Bigelly colliery, for instance, requires "square timber" in headings only six feet square, to the tune of $15,000 per annum for a delivery of about twice as many tons of coal, and half that small or culm, sold for burning lime at about a dollar per ton, whilst the portion above the size of an apple is generally worth at the mine from $3. to $4, and in London double that price, for kiln drying malt, hops, &c. The difficulties stated, and narrow breadth from the crop to the centre of the basin, there greatly limit the production of this quality of coal. The demand at that high price is of course also limited. As tender strata, trouble, faults and undulations of the seams occur in the Pennsylvania field much in proportion to the high quality of the coal, so is it in Wales. East of Pembrokeshire the seams are under Carmarthen Bay. Thence their course is under the Gwendraith River and flats, about fifteen miles, the number of seams being about twelve, from 2 feet to 10 feet thickness. There is at Trimsaran and other places along this distance a second edition of these seams, the length of a mile or two at intervals, so that in those "reaches" we find the crops of near thirty workable seams. This second series is of tender and free burning quality, as that of Carbondale. We have now passed along about 30 miles of the course of the seams, in which distance the thickness of coal may average 70 feet, the inclination 1 at 4. Scarcely an acre is worked below the level of the river mentioned. Millions of tons are workable above that level, with

the Ridwelly Canal along the seams, and its terminus at fine harbors. The Gwendraith coal, lately mentioned as tried successfully in a steamer by Mr. Wadney, is a fair sample of this body of coal, and I shall endeavor to show the state of matters as regards its use in London.

My patron, partner, &c., the late Mr. Brogden, (a pupil of Dr. Priestly,) was advised by him to buy Trimsaran (before mentioned), as the greatest mass of coal in the kingdom. There as manager of the mines he and I spent 20 years. In 1830, Dr. Nott, late President of Union College, arrived in London with his patent stove. I had introduced screened anthracite to about 60 steam engines, distilleries, &c., about London. *Culm* being duty free to London, screened anthracite under the size of an apple, was admitted duty free, and thus we balanced the extra freight from Wales as compared with Newcastle coal. I required only sufficient surface of fire grate to make this screened anthracite the most economical steam fuel in London, as well as smokeless, &c. It was brought to the landing shaft at 35 cents per ton from a 3 feet seam, all *labor* included, and four boys, by a water balance, and screens without motion, lifted the coal up a shaft 100 feet deep, banked it to the screen which sent it to the cars, of five sizes, (the mere dust taken out of the pea coal,) all at the cost of a cent per ton, the four boys passing off 100 tons daily. *A step* for the coal to fall over, at every foot length of each screen, was the secret of this being well done. I must here say I lately saw 17 men and a steam engine at a *screen* (for they want no breaking) on a railway from *Auburn*, who all send off only as much as the boy at my screens, above half their coal being wasted in the creek. So that the "art of screening" is not likely to do much more than it has done for the anthracite trade in London.

The beautiful and excellent stoves of Dr. Nott and others being rejected in London, we have to "wait for the echo." The geologists estimate that there is coal in the South Wales basin to supply the present consumption of Britain for centuries after the Newcastle coal field is exhausted, and such is the regularity of *all* coal in Britain, as compared with anthracite there or in Pennsylvania, that Messrs. Pemberton, who sunk the first shaft to the centre of the Welsh basin, on the bituminous seams at Llanelly Carmarthenshire, at a point where Trimsaran anthracite would by its inclination be about a mile deep, and afterwards sunk the deepest shaft in the north of England, 1800 feet, at Sunderland, concurred with me in the opinion, that the north of England would be worked to double that depth before the coals of Wales generally would interfere in the trade of London. And I foretell that the Atlantic cities will use a large portion of bituminous coal before London is compelled or induced to use, for household purposes, either Welsh or American anthracite. The discovery of the lower seams at Pottsville may be a great matter, and the western portion of the anthracite field may be great, but for the rest, all points considered, there is little need to seek a *market*.

No doubt one third the grates in London are half the year without fire, another third the fire lighted three times a day, for a teakettle is boiled, &c., &c., at the consumption of about a pint of coal and wood, so easily is Newcastle coal brought to its work, while anthracite must be in a body of fire continually, or take wood to light it which would do all the London lady has to do, besides attending to her *shop*, &c., &c.

I must return to the anthracite coal field of Wales by saying, from the said fifteen miles under the Gwendraith River, the 70 feet thickness of seams pass six or eight miles over table land to the line of the Amman River and Railway, and follow that, five or six miles, to the boundary line of Carmarthen and Glamorgan, and thence across the canals of Swansea and Neath about fifteen miles. At the head of the last mentioned canal *these* seams *become* "smoking" coal. The amount of *Ironstone* gradually increases along the whole distance. The underlevel workings along this latter half of the 70 miles are next to nothing, and the *width* of seam workable, (at Newcastle depths,) say a *mile*, as the inclination comes gradually down to 1 at 8,

seventy square miles,=44,800 acres, at 70 feet=100,000 tons per acre. A fourth part of this coal approaches the quality of the black marble anthracite first mentioned, is *hard* as the best seam of American anthracite, so that I do not agree that the *quality* of the latter can give great advantage. This coal is on board ship at the cost of a dollar per ton. I spent the best of my days *selling* it in the ship, six miles from the mines, at little above a dollar, which brought me to America in the search of a "better country." The freight to London, $2½ per ton, will make its cost there very much the same as coal in New York. As to the idea of that coal going to London, I advise that Massachusetts be *first* well "cared for." The Pottsville Journal has quite a review of the coal trade. Gives the price of Newcastle coal in Boston at $12 per ton, yet the same article says a ton of anthracite is equal to a ton and a half of Newcastle coal. The latter is $4 in London. The "blank reaches" in Wales, are a drawback on the quantity workable, which the "overlays" do not make good. The amount of rent or royalty per ton paid in each country is of course an item in the cost price, and it will surprise most men to hear that rent per ton of this country cannot be taken at less than double that of Wales generally. Where a capital of $30,000 will win a colliery, for twenty years, by steam pumping, say 200 feet deep, 12 cents per ton would be the rent. It is so at the Rhymney Iron Works, almost the last lease of importance, and where the seams of coal and ironstone are in fact won by nature as they are intersected by ravines, and the gangways begin almost in coal. An extraordinary "debut" was made by the semi-anthracite or "Llangenneck" coal about the time I have mentioned, 1830, it taking with the brewers and steamboats in London at about $6 per ton when Newcastle coal was at $4. The breakage or small of it being useless, the strong bituminous coal of Wales ultimately beat it. These coals, with or without fan blast, are the articles the American and Welsh anthracite have to supplant in steamboats. The geological change from the anthracitous quality to *semi* is *across* the Carmarthenshire portion of the basin. Overlaying seams, as in the west of Pennsylvania, so in Wales, and at high elevations *horizontal* seams occur *over all* the others; they are bituminous and tender. There is no semi between the anthracite and smoking or iron making coal in the *seams* and *line* of *course* I commenced with. The east end of the basin is highly bituminous and hard, all the south bituminous and tender. T. B.

THE COAL FIELDS OF OHIO, AND COAL CONSUMPTION OF ITS CITIES.

We have several times touched on this subject, with a view to exhibit the economical value of coal; the prodigious resources of Ohio in this mineral; and its future development. The development of coal is the result of high civilization; and hence coal mines are not thoroughly worked, till a country begins to have large towns, and is well advanced in the arts. This is now the case with Ohio, and accordingly capitalists, manufactures, artisans and citizens, are all beginning to turn their attention to the supply of coal. Some ten or a dozen coal companies have been formed within two years in Ohio, for working mines in the north-east part of the State. The production of coal has doubled in the same time; and the consumption would increase at a more rapid rate if there was a sufficient supply.

As this is a subject of great interest to railways, as well as the public generally, it may be well to examine the *causes of demand*, the *sources of supply*, and the probable *development of the coal region*.

1. *The Causes of Demand.*—Of course, while wood was the cheaper fuel, coal was very little in demand, except for some sorts of iron work—for which it is absolutely necessary. But this has ceased to be the case. Wood, on the rivers, canals and railways is becoming rapidly exhausted, and at the large towns is therefore proportionally high. At Cincinnati, where fuel of every kind is highest, the ratio of expense in burning wood and coal is about *two to one*. In other words, coal at 25 cents a bushel is cheaper than wood at $5

per cord. But with proper care, coal may be laid in the cellar at 12½ cents per bushel. In the interior of the State, we are told, coal at 20 cents is deemed cheaper than wood at $3. But at Chillicothe, Columbus, Circleville, and many other interior towns, coal can be had at 8 cents, and in these towns the consumption is increasing rapidly. In domestic consumption of fuel, we may assume that in a short time coal will be used in all the considerable towns of the State.

Another and equally important source of demand are the factories, workshops and blacksmiths. There are now *twenty* great establishments that will consume five millions of bushels; *fifty* smaller ones that will consume an equal amount; while the furnaces, forges, and blacksmiths consume as much as all the others. This consumption must amount in all to twenty millions; although, it will be observed, that nearly half of it is used in the coal mines by furnaces, forges, etc.

Another important demand is caused by MILLS. Twenty years since, it would have been deemed a positive absurdity to say that coal would be used to move mills, when there was water power present! But now the thing is reversed. It costs more to build and keep a dam in repair, than it does to run a steam mill. The consequence is that we find steam mills all over the State, beside streams that formerly furnished the power. In this the railways have greatly assisted; for to a flour mill, *locality* is of importance. Hence, steam mills are now erected near the railway depots, where the carriage and handling of the wheat, flour and coal are all convenient. In a few years it will require at least ten millions of bushels of coal to supply the steam mills on the railways, and this amount must all be carried on the roads.

2. *The Sources of Supply.*—Ohio is estimated to contain a coal field equal in extent to *twelve thousand square miles*, or one third the surface of the State. The eastern and southern boundary of the Ohio coal fields, is the Ohio River; the western commences some ten miles above Portsmouth, and runs on a line a little east of north to the western line of Summit County. Within this limit are some counties, such as Fairfield, in which coal has not yet been found. It is nevertheless quite certain that coal underlies them, and probably at no great depth. The counties which at present produce most coal, are Meigs, Athens, Muskingum, Summit, Jackson, Jefferson, Trumbull, Tuscarawas, Belmont, Guernsey, Lawrence, Stark, Hocking, and Vinton. Besides these, coal is found in Gallia, Washington, Coshocton, Licking, Morgan and Carroll. The present amount of coal *dug*, including that consumed on the spot, is estimated at the following amount:

Counties.	Bushels.
Meigs,	8,000,000
Athens,	1,500,000
Summit,	4,000,000
Stark,	1,000,000
Tuscarawas,	500,000
Muskingum,	2,000,000
Lawrence,	2,000,000
Jackson,	1,000,000
Vinton,	300,000
Coshocton,	300,000
Jefferson,	1,000,000
Belmont,	1,000,000
Licking,	200,000
Trumbull,	500,000
Washington,	200,000
Monroe,	200,000
Morgan,	100,000
Aggregate,	23,800,000

The above is probably an under estimate, and certainly will be for the future, in which the demand and supply will probably be doubled in the next two or three years.

The following is the amount of coal *arrived*, as near as we can ascertain, in the chief towns of Ohio:

Towns.	Bushels.
Cincinnati,	8,000,000
Cleveland,	6,000,000
Columbus,	1,000,000
Chillicothe,	300,000
Circleville,	200,000
Dayton,	120,000

Other towns consume enough to make in all twenty millions of bushels. The town population of Ohio will, in half a dozen years, amount to half a million, and this will require fifteen millions for household consumption: while the foundries, factories, and shops of all descriptions will require twenty-five millions, independent of furnaces and forges. This brings us to the third topic, viz:

3. *The Development of Ohio Coal Mines.*—We see that independent of the coal consumed at the mines by furnaces, forges, and other works, *forty millions* of bushels will be required in the towns, and will require transportation one half by railway, which will make *eight hundred thousand tons*, in addition to what the railways now have. But this amount will be increased annually at a rapid rate; for, when a State has arrived at a point in which its lands are mostly occupied, the arts and manufactures grow immensely, and that is the position of Ohio now.—*Rutland Record.*

MINERALS OF WESTERN KENTUCKY.

The eastern portion of Kentucky has been known to be rich in mineral productions, and portions of it have become important for the use that has been and is to be made of them.

It has not generally been known, however, that the western portion possessed much, if any, valuable mineral land. This region has lately been traversed by Dr. Owen, the State geologist, and is found to contain much that is valuable and important, hidden among its rocks.

The Doctor says that throughout the whole southwestern coal field of Kentucky, from the sources of the Tradewater in Hopkins County to Green River in Muhlenburg County, the whole region is full of geological interest. There is hardly a section of a stream or ravine but what discloses materials that must at some period be a source of wealth to the owners of the soil.

In the section laid bare from the lowest ground in Richland Creek to the summit of Wright's Ridge in Hopkins County, which may be comprised in a vertical cut 300 to 350 feet high, with its base about 200 feet above high-water in the Ohio, there are six workable beds of coal. The average thickness of these beds is nearly five feet, and their united thickness about 30 feet. Three of these beds lie within a vertical space of 80 feet toward the base of the section, as shown on the Hunting branch of Clear Creek, near the dividing ridge between the Tradewater and Pond River.

Around the uplift of the strata prevalent in the vicinity of Wright's Ridge, the whole of these six beds are accessible above the drainage of the country. It is also probable that the detailed survey may discover intermediate beds of coal now hidden by debris. These beds feather out towards the south, the lowest one having its southern limit in the northern portion of Christian County and the southern confines of Muhlenburg County.

These coal measures, dipping toward the north and north-west, toward the great Illinois coal field, underlie the whole of Henderson and McLean Counties, modified probably in thickness, relative proximity and quality.

In reference to the quality of the foregoing coals, the chemical analysis of six varieties, obtained where there was the best opportunity of receiving fair samples, will show their value.

1. Specific gravity, 1.278.	
Water and volatile gases,	43.2
Fixed carbon in coke,	54.8
Ashes (light gray),	2.0—100.00
2. Specific gravity, 1.218.	
Water and volatile gases,	41.48
Fixed carbon in coke,	54.72
Ashes (white),	3.80—100.00
3. Specific gravity, 1.339.	
Water and volatile gases,	40.75
Fixed carbon,	50.25
Ashes (white),	9.00—100.00
This coal underlies the black-band.	
4. Specific gravity, 1.305.	
Water and volatile gases,	45.20
Fixed carbon,	50.70
Ashes (gray),	4.10—100.00
5. Specific gravity, 1.294.	
Water and volatile gases,	43.75
Fixed carbon,	50.75
Ashes (nearly white),	5.50—100.00
6. Specific gravity, 1.270.	
Water and volatile gases,	42.47
Fixed carbon,	56.13
Ashes (pale flesh colored,).	1.40—100.00
Liverpool coal analyzed by Johnson.	
Specific gravity, 1.260.	
Water and volatile gases,	40.48
Fixed carbon,	54.90
Ashes,	4.62—100.00

The comparison between some of these specimens and the Liverpool, is not unfavorable to the coal of Kentucky. The unusually small quantity of ashes found in No. 6 of Kentucky coal, renders it peculiarly suitable for manufacturing purposes.

The black-band iron ore mentioned as overlying No. 3, is found in the southern part of Muhlenburg County, in some places of a thickness of nineteen inches to two feet, occurring sometimes in compact, tabular ponderous layers, almost as black as coal; sometimes of a shaly structure or in immense segregrated masses, composed of alternate layers of black and reddish-gray. In Hopkins County it varies from three inches to one foot, and usually presents the form of solid, heavy, dark-colored slabs, like flag-stones. This appears to be accompanied by one if not two beds of limestone not immediately overlying it, but in such a position that there is good reason to believe that one of these beds will be found within convenient distance.

The other varieties of ore which occur in these counties are of much greater thickness. The argillaceous shales which almost immediately overlie the black-band are often rich in argillaceous iron ore, and the ordinary varieties of carbonate of the protoxide of iron; similar ore occurs also in a higher geological position. The clay iron-stone occurs mostly as kidney-shaped segregations disseminated through the shales, which scale up and exhibit the concentric laminæ of which they are formed.

On Batist Creek an ore bank of this kind occurs from two and a half to three feet thick, which supplies much of the ore used at the Buckner Iron Works. In the same county the light-colored shales overlying the black-band are from four to five feet thick, one half of which may be considered good iron ore; also on a high ridge one and a half miles south-east of this furnace on the waters of Lick Creek, a soft calcareous and fossilifferous ironstone occurs, which is ten feet thick or more; this ore has also been partially worked

for the use of the same furnace. The ferruginous shales over coal No. 5, are often fifteen to twenty feet thick or more, but the quality and quantity of the disseminated iron ore is variable, and generally in greater force in Muhlenburg than in Hopkins County. There are often observed considerable bodies of hydrated brown oxide of iron associated with the sandstones overlying the higher beds of coal; this ore, however, is prone to be too silicious to be profitably worked; though in the absence of better ores, this species of iron ore might be worthy the attention of the iron-masters.

This vast amount of mineral wealth distributed through this portion of Kentucky, may be said to be almost dormant; even the coal banks which have been in some instances partially opened, afford as yet but a very paltry revenue to the owners.

SPONTANEOUS COMBUSTION OF BITUMINOUS COAL.

I have, through the kindness of M. C. Younglove, Esq., been permitted to witness an instance of the spontaneous combustion of bituminous coal which has interested me much, and which, from its bearing on the interests of all who deal in coal or use it in considerable quantities, may be worth reporting.

Messrs. Younglove and Hoyt have used for years in the furnaces of their extensive steam paper-mill in this city, our bituminous coal. Of late years they have found it most economical to employ the "slack" or small coal, which differs in nothing but in the size of the lumps from ordinary marketable coal. Of this coal they have usually obtained their winter's supply during the summer months, taking it directly from the boats and piling it on their dock—plank resting directly on the earth—in heaps of from 25,000 to 35,000 bushels. These heaps are exposed to the weather without protection, and have been so deposited and used for a succession of years without accident, and without apparent deterioration. This year their coal has been received as usual, and forms a heap of an oblong form—at its base some 40 feet long by 20 wide, and from 8 to 10 feet high—containing some 25,000 bushels or more. A few days since the proprietors of the establishment received intimation from their engineer that "their coal heap was on fire, as it was hot all over, and steam was rising from it." On examination they found it even so. The heap was sensibly hot on all sides, and a plank lying on the top so hot as to be painful to the hand applied to it, and on digging to the bottom they found a portion of the coal fully ignited, and which blazed up brightly on the admission of air. They immediately turned a copious stream of water on the top of the heap to extinguish the fire. I examined the coal heap the next day with Mr. Younglove. We found the fire partially extinguished by the water, but apparently through all the interior, a stratum of coal from 1 to 2 feet thick, lying next the planking, was perfectly coked, and some of it still ignited. The planking was completely charred.

The coal used by Messrs. Younglove and Hoyt is the "Chippeway," one of the best and purest varieties to be found in our market. The fire was in this case unquestionably due to spontaneous combustion, as the exterior of the heap on all sides was composed of coal which had suffered no change, but was found as fresh and bright as when mined; only the interior and most inaccessible portion of the pile was ignited: The combustion was without doubt excited by the decomposition of the bi-sulphuret of iron—that is, the change of the sulphuret into the sulphate (copperas) by the absorption of oxygen.

This instance of spontaneous combustion in our bituminous coal, will suggest to those in the coal trade, and to consumers, the propriety of at least keeping in mind the fact that coal may spontaneously ignite, and that large heaps of small coal should not be permitted to be for months undisturbed, nor be placed in combustible receptacles, or in such relations to combustible matter that spontaneous combustion, if it should happen to occur, would be productive of disastrous consequences. It must be confessed, however, that the

danger is not great, that the peculiar circumstances necessary to spontaneous combustion will co-exist in any considerable number of cases—according to the law of chances, the probability is exceedingly small that such will be the case—and yet the bare possibility of the thing should put us on our guard, and lead us to protect ourselves against it.—*Cleveland Herald.*

THE CATAWISSA RAILROAD.

One of the pleasantest festivities of the season took place on the occasion of the inauguration of the Catawissa Railroad. This work is 63¼ miles in length, commencing at its junction with the Little Schuylkill Railroad, 8¼ miles north of Tamaqua, and extending by way of Catawissa to the town of Milton, on the west branch of the Susquehanna River, in Northumberland County. At Milton it connects with the Sunbury and Erie Railroad, which forms a link to Williamsport. At Williamsport a link is formed with the Williamsport and Elmira Railway, extending from the first to the last named place, where it meets the New York and Erie Railway. This puts the road in connection with Lake Erie, at Dunkirk, and the great west by means of the Lake Shore road, and with Buffalo by means of the Buffalo and New York City road. The Little Schuylkill Railroad, which is 23¼ miles in length, extends from its junction with the Catawissa road to Port Clinton, where it connects with the Philadelphia and Reading Railroad, 78 miles of which are used to put the route in connection with Philadelphia. From these facts it will be seen that the Catawissa Railroad is part of a series of railway connections between Philadelphia and the great Lakes.

From the speech of Mr. Price, the Treasurer of the Company, made on the occasion, we take the following extract relative to the facilities furnished to coal companies:—

There are yet twelve miles of our road to make from this place to Sunbury, a considerable proportion of which is already graded. This portion may be easily finished by early spring of next year, except the bridges at Northumberland,—and for a temporary purpose, a small steamboat may be run across the river to convey the cars from one side to the other, until the bridges can be completed. There will then be an outlet for the immense deposits of anthracite coal at Shamokin and its vicinity, for which there is now scarcely an access to market. I have seen a statement to-day, prepared by a gentleman thoroughly conversant with this region, in which it is stated that the various Coal Companies having their works located there, are preparing to take out 1,500,000 tons of coal per annum, as soon as they are assured of an outlet.

It is well known that there is a large and increasing demand for this coal throughout Western New York, and the other States bordering on the great Lakes. If this estimate seems too high, suppose we reduce it by one third, and that only 1,000,000 can be furnished by these companies for the first year or two, and that only half of this amount will be sent northward over our road for a market; and I believe every one who has examined the subject will say that this is an under estimate. I am informed, by the highly intelligent President of the Reading Railroad, that their charges for the conveyance of coal, is two dollars per ton for the whole length of their road, or, over two cents per ton per mile; and that the actual cost to the company is six mills per ton per mile. He thinks that eight mills per ton per mile would be a fair allowance for the actual expense of transportation of coal on that part of the Sunbury and Erie road from Sunbury to Williamsport, a distance of 40 miles, and on which there is no gradient exceeding ten feet per mile. But suppose, for the sake of abundant margin, we say that the actual expenses will be one cent per ton per mile. A charge then of two cents per mile, or 80 cents for the whole 40 miles, will yield on a tonnage of half a million a year, a gross revenue of $400,000, and a net income of $200,000. This of itself, from this

single item of trade, affords a clear profit of ten per cent. upon a capital of $2,000,000; a sum which will fully cover the cost of this part of the road. I appeal to every intelligent gentleman present, familiar with the present state of the coal trade and its future prospects, if these calculations are not far within, rather than beyond, what will be almost certainly realized from the very opening of this portion of the road, with a prospect of future increase that it would now appear visionary to indulge in a calculation of. If this single item will thus almost beyond the possibility of doubt, produce a net revenue of ten per cent., it is not unreasonable to calculate that the miscellaneous and passengers business will yield as much more.

It is not this part of the road only that will prove highly profitable as an investment of capital. Every successive link that shall be completed, will open up new regions of country and new sources of revenue and profit. The line now about to be opened to Williamsport, meets there a present manufacture of lumber of many millions of feet per annum, often very seriously disadvantaged for want of a ready mode of transport to market. The next link—to Lock Haven—passes through one of the most beautiful and productive valleys of our Commonwealth, and at that town is another point where the manufacture of lumber is carried on to a very great extent, with every prospect of an immense future increase. From this point the road penetrates for a hundred miles what is now to a great extent a wilderness, but which abounds in the greatest profuseness in those productions of nature which afford the most profitable employment for railroads.

Almost the whole of this region is underlaid with beds of bituminous coal of a very superior quality. It abounds in inexhaustible supplies of iron, requiring but the hand of industry and a means of transportation to make it tributary to the wants of man, and add incalculably to the wealth and population of this neglected portion of our Commonwealth. The surface of this same region is covered with the finest forests of pine and other timber now existing in our State. Indeed, they will afford almost the only extensive supply of lumber that now remains to us; the demand for which is so great and constantly increasing in price in our eastern cities.

IRON ORE IN VIRGINIA.

Speaking of iron, a Virginia paper says there is ore enough in Montgomery County, in this State, to build a railroad with a double track of heavy T rail, 210 tons to the mile, from Washington City to San Francisco. It is found at different points within from one to five miles of the Virginia and Tennessee railroad. The ore is of the best quality, rich enough to yield from 50 to 75 per cent. of pure iron. This ore can be mined or gotten out at a cost of from 12½ cents to 50 cents per ton, it being situated on gentle slopes in immense ledges, from which it can be blasted in large masses. The writer goes on:

"There is stone coal of the very purest and best quality for iron manufacturing purposes, enough within from five to ten miles of the Virginia and Tennessee railroad, (and to which a branch railroad will be built in 1855) to supply the demands of the whole world for years. In short, an inexhaustible amount, which is so situated that it can be mined at a cost of from 50 to 75 cents per ton. There is on New River, Little River and Roanoke and their branches, in the county of Montgomery, convertible water power to at least 10,000 horse power. The country, though fertile and productive, has still a very large proportion of heavily timbered forest, from which might be obtained immense quantities of charcoal and fuel. The foregoing facts are strictly true; and yet, strange as it is, there never has been a ton of iron made in the present limits of the county of Montgomery.

THE COAL MINES OF NOVA SCOTIA.

We are indebted to the kindness of a gentleman for the following extract from a private letter bearing on the subject of the Nova Scotia coal mines:—

PICTOU, NOVA SCOTIA, *October* 8, 1854.

Between thirty and forty years ago the English government laid claim to and owned all the mines and minerals in the province of Nova Scotia. About that period the exclusive right to work them for sixty years was given to the Duke of York. This right the Duke sold to his creditors in payment of his debts; and they formed a company, which company is now known as the "*Albion Mining Company*," and are engaged in working the mines at Pictou and Sydney. This company enjoys at the present time the exclusive right to all mines and minerals in Nova Scotia, and will continue to do so for thirty years to come, unless there be some new action on the subject.

If a person owns a tract of land, and upon it he discovers a mine of gold, silver or coal, he can only work the latter for his own consumption, the others he cannot work at all.

Such is the state of the case at present; but I do not think it will continue very long. Last year I procured the passage of a bill by the legislature of this province, allowing "aliens to hold property in real estate." This will be of great importance at no distant day, and prove the means of introducing American capital and American industry. I know of no country possessing greater inducements for such investment than Nova Scotia.

The demand for Pictou coal, this year, has far exceeded any former year; but not one half the quantity wanted has been supplied. I understand the company will make great improvements in their works next year, and greatly increase the quantity of coal to be shipped.

Your most obedient servant,

S. DE WITT BLOODGOOD. J. H. N.

IRON AND ZINC.

AMERICAN AND FOREIGN RAILROAD IRON.

The demand for iron in the construction of railroads in this country, has hardly commenced as yet, although an immense amount has already been used. The importance of this subject to the iron interest is surpassed by none other. For this reason we have made room for the following article from W. W. Mather, in the *Railroad Record*, on American and Foreign Iron:—

In a former article on "American and Foreign Railroad Iron," the reasons that have operated to prevent the extension of its manufacture in the United States, have been shown to be—

1. The American iron-masters are fully employed to supply pig iron for castings and for making merchant iron.

2. Railroad mills require more capital, and where their pig iron is purchased at high prices, do not receive a profit corresponding to the pig iron manufacturer.

3. Large amounts of capital are not easily diverted in the United States from the usual channels of business, very profitable and well understood by those owning or employing it.

4. The long credit given on railroad iron in England by mortgage bonds on the railroads, instead of money or short credit that has been required in the United States, has drawn nearly all the calls for railroad iron in that direction.

5. Any extension of the manufacture of railroad iron in the United States, must be by smelting the iron ore with stonecoal.

It is now proposed to show, that with suitable encouragement, the United States, and particularly Ohio, can within a few years supply railroads with American railroad bars as cheaply as the Welsh bars are now furnished, and with as much credit on bonds, and after the works are well established, as cheaply, even if the duty be removed from railroad bars.

Of the resources of the United States in iron ores adapted for the manufacture of iron, there is no question.

To make railroad iron in competition with South Wales, our iron-masters must come into the market on equal terms as to *cost* and *credit*. To come into the market on equal terms as to *cost*, requires—

1st. Abundance of ores, cheap, and of easy working qualities.

2d. Fuel and fluxes for smelting, abundant and contiguous to the furnaces, or at least cheap.

3d. Facilities for easy and cheap transportation and extensive distribution over the country.

To come into market on equal terms as to *credit* requires, 1st, that we should be able to deliver railroad bars at cost of transportation, duties and charges, on Welsh bars now paid for in money, as the cash payment; and 2d, receive the cost of production in railroad bonds for the balance of the market value of the iron.

Relative advantages of the East and West for production.—In New York, New Jersey, Connecticut, Massachusetts, Vermont, and the Eastern States generally, the ores are very rich, and not so easily reduced as the ores of the coal fields of Pennsylvania, Ohio, Kentucky, and Western Virginia; or else the more easy working ores, such as the hematites and limonitii ores, cannot have the advantage of cheap fuel for their reduction.

At many of the furnaces in the Eastern States, all the materials are brought from a distance, and the ores cost $3, $4 or $5, per ton,* charcoal 5, and 7 to 12 cents per bushel,† bituminous coal 25 to 30 cents per bushel,‡ and anthracite 16 to 19 cents per bushel, and at many places 25 to 30 cents per bushel. §

In Maryland, Pennsylvania, Ohio, Virginia and Kentucky, materials for the manufacture of iron are found in many places, either immediately contiguous to each other, or in the immediate neighborhood, so that the coal, iron ore, and limestone for smelting and manufacturing the iron, and the building materials and water are all most convenient for use.

Various circumstances modify materially the cost of the production of iron, among which the principal are—

1st. The cost of lands for furnace supplies.

2d. Qualities and quantities of ore and coal.

3d. Cost of stock at the furnace.

4th. Cost of labor at the furnace.

5th. Cost of provisions at the furnace.

6th. Easy and cheap transportation and distribution to various markets.

The advantages thus far in the iron manufacture in the United States, have been in the southern part of the iron belt of Ohio, where the iron-masters have all, with a single individual exception, in a long course of years, and in all stages and fluctuations of the iron market, made money and grown rich.

* Ores delivered at the furnaces in Southern Ohio cost from 75 cents to $2,50 per ton, but the average of the best ores and the customary price is $2 per ton in the coal and iron district of Southern Ohio.

† The average price of bituminous coal in New York from 1821 to 1846 was $9,31 per ton, or about 33 cents per bushel. The cost of bituminous coal delivered at the works in the coal and iron region of Ohio is $0,75 to $1,50 per ton, or 3 to 6 cents per bushel, according to the situation of the works, near or more remote from the mines.

‡ The price of anthracite in New York usually ranges from $6,50 to $7,50 per ton, or 16 to 19 cents per bushel, and in Philadelphia has ranged from $7 to $4 per ton, since 1828. This year, coals of all kinds are dearer throughout the eastern slope to the Atlantic. Bituminous coal 22 cents per bushel at Philadelphia, Sept. 12; at Boston same date, $8,25 to $9,25 per ton, 20 to 23 cents per bushel; New York $7 to $8 per ton, 19 to 20 cents per bushel.

§ Charcoal on the Hudson River at the furnaces is worth 12½ cents, and the timber, if sold for timber and for fuel, would realize that amount and more. The charcoal of the Berkshire County iron works and the Vermont furnaces, costs from 5 to 7 and 10 cents per bushel delivered. Charcoal at the furnaces in Southern Ohio has heretofore cost about 3 cents per bushel delivered, now with increased prices 3½ cents, and in some cases 4 cents.

The advantages for the future in the manufacture of railroad iron will, it is believed, be in Ohio, and for the following reasons, viz.:

1st. The abundance and easy access of easy working, good iron ores.

2d. The abundance and easy access of good stonecoal and limestone.

3d. The small cost of stock at the furnaces.

4th. The cheapness and abundance of provisions.

5th. The railroad and water transportation to distribute the iron easily in every direction.

6th. The great amount of iron required in future years, will be in the West, the Northwest and Southwest, in the valleys of the Mississippi and other streams flowing into the Gulf of Mexico.

Sites for furnaces, stonecoal iron and railroad iron.—The charcoal iron furnace sites in Ohio are already mostly occupied, or held in reserve for such use; but there are many sites adapted to the manufacture of railroad iron from stonecoal, that are still covered by their native forests, or are partially cultivated as farms, that are capable of producing iron for fifty miles of railroad per acre, or 3,000,000 tons to the square mile, with coal and limestone sufficient in the same lands, or very near, to make the iron. Furnaces can be so located in many places, that the ore and coal can be run from the mines by short tram roads of one fourth to one half mile in length to the tunnel head of the furnace.

The coal beds and iron ore beds in Ohio, lie in a nearly horizontal position, and above the level of the valleys, require little or no expense of drainage. Enough of these materials lie thus, to last extensive iron works many years, and below the levels of the streams are quantities to last for ages.

The face of the country in the iron belt of Ohio, is well adapted for getting the stock for the furnaces cheaply to the tunnel head. This is one great advantage over many of the Pennsylvania furnaces, which are situated in a more mountainous region, with deeper valleys, and steeper and higher hills.

Many bands of black, blue and gray carbonate of iron, like the black-band, and other ores of Wales, of Scotland, and of Staffordshire, abound in the southern counties of the iron belt in Jackson and Lawrence Counties in Ohio, and the coal, limestone, ironstone, fireclay and firestone, are associated. The resources may be considered practically inexhaustible, and Lawrence and Jackson Counties are considered capable of supplying one hundred stonecoal furnaces, each making 4,000 tons of iron per annum for ages of time.

Cost of furnaces and rail mills, to supply 500,000 *of railroad bars per annum in the United States.*—It has been estimated that the railroad iron production of the United States in Massachusetts, New York, New Jersey, Pennsylvania, Maryland, Virginia and Ohio, for 1854, will be 160,000 tons. The wear and tear of railroads and the double tracks and switches, will require about 100,000 tons of railroad bars, by Mr. Mansfield's estimate,* which is not more than enough. Three thousand miles of new railroads for this year, and the same for some years to come, annually, will require 400,000 tons per annum.

The wants of the country will then require per annum . . .	500,000 tons.
The production now reaches	140,000 "
The amount required to be produced or imported . . .	360,000

This amount in whole, or in part, will require to be imported until our own works can supply the demand.

Stonecoal furnaces make, say, 20 tons of pig iron per day; at the rate of 20 tons per day and two hundred days in blast per year, each furnace would make 4,000 tons.

Three hundred and forty thousand tons of railroad bars would require about 400,000 tons of pig iron, which would require about 100 stonecoal fur-

* Welsh bars, the wear and tear is found to be 4.1 per cent. on the Schuylkill coal railroad American, do. 1.6 per cent.

naces to produce; and 25 rolling mills making 45 tons each per day, three hundred days per year, to manufacture into railroad bars.

100 stonecoal furnaces with coal and ore lands for their supply would cost, with fixtures, etc., at $40,000 each	$4,000,000
25 railroad mills complete at say, $80,000 each	2,000,000
The investment necessary to produce 337,500 tons	$6,000,000

The duties paid at the custom-house on railroad bars in 1853, was $3,721,600, and as estimated in the year 1854, will be $4,000,000. It thus appears that the duties alone paid on railroad iron in one and a half years, if invested in furnaces, lands and mills, for making railroad bars, would be sufficient fixed capital in iron works to produce in the United States the quantity of railroad iron that is now imported, and bids fair to be annually required in all future time.

This amount of iron is now imported at an expense of about $12,400,000, paid in cash down, $16,000,000 in railroad bonds, which draw as interest $1,000,000 annually.

Estimated cost of stone coal, pig iron, four hundred tons at one furnace in Ohio.

Interest on $40,000 investment in furnaces, lands, buildings, etc.,	$4,000
Taxes, incidentals, repairs, etc.,	4,000
10,000 tons iron ore at $2 to make 4,000 tons iron,	20,000
400,000 bushels coal at 5 cents,* do. do.	20,000
2,000 tons of limestone at $1 per ton,* do.	2,000
Labor about the furnace at $2 per ton,	8,000
Handling, weighing, and transporting to rolling mill,	4,000
Cost of 4,000 tons pig at rolling mill,	$62,000
Or $15,50 per ton.	

Estimate for converting pig iron into railroad bars.

Interest on capital $80,000 at 10 per cent. 13,500 tons railroad bars—per ton,	$0,59
Wear and tear of machinery and repairs per ton,	1,50
Boiling furnace expenses per ton,	6,00
Rolling into muck rolls per ton,	0,50
Catching, hooking, dragging out and shearing per ton,	0,87½
Piling, strapping, heating, rolling, catching, drawing and straightening per ton,	3,00
Sawing, trimming and straightening per ton,	0,60
Coal, 25 to 60 bushels, say 60, at 5 cents,	3,00
Engines, oil, and miscellaneous per ton,	1,00
Incidentals, interest on floating capital, weighing, drayage, discounts, and extras of the boiling furnace,	5,43½
Cost of converting pig into railroad bars about,	$22,00†

The cost then of railroad bars at the depot or landing would be—

Pig at the rail mill per ton,	$15,50
One fifth loss in manufacture,	3,10
Cost of making pig into railroad bars,	22,00
Total cost of railroad bars per ton,	$40,60

This cost of $40,60 per ton is upon the supposition that the furnaces are separate from each other, and from the rail mill, but that four blast furnaces and one rail mill belong to the same company.‡

* Stonecoal at some of the furnaces costs only 5 cents, and 2½ tons to 3 tons would perhaps be enough, equal to from 62 to 75 bushels per ton of iron.

† The above details may not be accurate, but the cost of conversion in the aggregate, is believed to be not far out of the way. The writer has had no recent opportunity of conferring with those engaged in this manufacture.

‡ If the furnaces are in pairs, the expenses of production would be diminished something

If the *furnaces and rail mill belong to different companies* the account would stand very different, and the pig would cost the rail mill company the market price of say $40 per ton.

One and a fifth tons pig to make one ton railroad bars $48; manufacturing into one ton, $22, equals $70.

The margin for profit is thus seen to be less by far, not only relatively but absolutely, than for the blast furnace making pig iron, and explains satisfactorily, that so long as the iron market is not glutted with pig, there is comparatively little inducement to make railroad iron, unless the company own both furnaces and mills. The eastern manufacturers are now in this situation, that the pig iron, whether bought or produced, costs nearly $40 per ton, and the western manufacturers also, that buy their pig iron, are in the same situation.

Estimated annual production of four stonecoal furnaces and one mill.

Four furnaces making 1,000 tons each, at $15,50,	$248,000
One rail mill say from 16,000 tons, 13,500 tons rails,	297,000
Cost of 13,500 tons rails at $40,37 per ton,	$545,000
Sale price N. Y. quotations, lowest, $73,50	$992,250
" " " $80,00	$1,080,000

At the above prices, the range of profits for such a company, their works all separate, would range from $447,250 to $535,000.

If the works were together, the cost of the railroad iron would be about $37,60 per ton, allowing the cost of ore $2 per ton, of coal 5 cents per bushel; 100 bushels per ton of pig iron, and 60 bushels for converting into railroad bars. Iron men will allow these to be high estimates, and many localities will bear a reduction of ore from $1 to $1,50 per ton, and coal to 3 cents; which would reduce the cost $3,25 to $4,50 per ton of pig, and railroad bars $4,45 to $5,70 per ton, and make railroad bars cost from $31,90 to $33,15, and stonecoal pig $10,75.

The sale prices of railroad bars in Wales, were, August 8th, £7 15s, £8 5s, about	$38,75 @ $41,25
" " August 26th, £7 15s, £8. 5s., about	$38,75 @ $41,25
In New York the quotations were, August 23d, railroad bars,	$77,50 @ $80,00
September 2d, American railroad bars,	$77,50 @ $80,80

It thus appears that in the Pennsylvania and Ohio coal fields, railroad bars can be made in favored localities at $31,90 to $33,15 per ton, and generally at $37,60 to $40,37 per ton, and the sale price be highly remunerative. It also appears that we can make iron, both pig and railroad bar, as cheaply as in South Wales.*

more than a dollar per ton; and if all the four furnaces and mill be together the expenses would be about $3 less, or about $37,60 per ton of railroad bars.

* *Cost of making pig iron.*

Merthyr Tydvil, (Ure's Dictionary.)

	Tons.	*Cwt.*	*Qrs.*	£.	*S.*	*D.*
Raw iron stone, 10s. per ton, $2.20,	3	7	0	1	13	6
Coal 6s. per ton, $1,32	2	16	0	0	16	6
Limestone 1s. per ton, $0,23.	1	5	2	0	1	4
Other charges, $2,02,	0	0	0	0	0	1
Total,	7	6	2	3	0	5

Total cost not reckoned on interest or capital.

Glasgow, Scotland, (Ure's Dictionary.)

	Tons.	*Cwt.*	£.	*S.*	*D.*
Raw iron stone, 4s. 6d. per ton, $1,00,	3	10	0	16	3
Splint coal, 2s. 5d. per ton, $0,54.	5	15	0	14	0
Limestone, 6s. per ton, $1,32,	0	14	0	8	6
Coal for engine, $0,66,	0	00	0	3	0
Other charge, $5,22,	0	00	1	1	0
Total,	10	9	2	17	9

The range of Ohio stonecoal pig will be in Ohio, $10 to $15 per ton, cost.

Pig iron has been made in Pennsylvania, it is said, at less than $10 per ton, but this is about the minimum in the most favored localities, and I think was estimated as in Wales and Scotland, without counting interest and taxes on the capital, and incidental expenses and repairs.

The usual cost of Welsh and Scotch stonecoal iron may be considered as about $12 to $15 per ton, and the present sale price in New York $38 to $40. In Pennsylvania and Ohio, such iron costs $12 to $15, and sells at say $40, but the expenses of sending these latter to a market are less than in the former, and to the advantage of the iron-master.

In the Eastern States, foreign pig iron cannot be bought for less than $40, neither can it be manufactured, either with stonecoal or charcoal, for much less than that price. Add to this, the expense of converting the pig into railroad bars, say $30 in the Eastern States, where coal, labor and provisions are high, makes the railroad bars cost about $70 per ton.

In the Eastern States, the railroad bars manufactured there, cost so nearly the price of Welsh bars, that if the duties be remitted, those railroad mills must close. It is not to be expected that in the Eastern States any great extension in the manufacture of railroad iron will take place in consequence of the cost of coal. In the anthracite region, and in the Frostburgh coal basin, and in the Tioga and Blossburgh districts which are intermediate between the Eastern and Western manufactories, rail mills will doubtless be established. In Pennsylvania and Ohio, where all the materials necessary for the manufacture lie together, in a rich agricultural and densely populated district, rail mills can make their bars at a less cost than any other part of our country—as cheaply and perhaps cheaper even than in Wales, as has been shown, ranging between $31,90 and $40 37 per ton.

The remission of the duties on rail bars would not affect the Western manufacturer more than diminish his profits to the extent of the duty, and this would not be so seriously felt as to destroy his business, *if he owns and works his own furnace and rail mill.*

If, however, the Western manufacturer buys his stonecoal iron at $40 per ton, or charcoal iron at $48 to $50 per ton, he has less advantage over the Eastern manufacturer, and in this case, he too will be unable, perhaps, during the fluctuations of the iron market, to make steady progress in wealth.

In Ohio, where the facilities for production and distribution exist in an unsurpassed, and perhaps unexampled degree, iron companies should have at least four stonecoal furnaces and one rolling mill, so as both to smelt and manufacture their own iron, and they need fear neither foreign nor domestic competition, nor remission of duties, nor the fluctuations of the market. There is no part of the world known, that can produce cheaper iron, nor more tons to the square mile over an equal area, than Ohio. Twenty-five such iron companies as above alluded to, located in the iron districts of Ohio and Pennsylvania, would, with what is now produced, supply the present and the immediately prospective demand.

At the present ruling rates of railroad bars, $78,50 to $80 per ton, our iron-masters could afford to receive $40 per ton in railroad bonds, (a part of which they could discount or sell if they wished,) and $31 to $33 in cash, which amount railroad companies now pay in cash for duties, shipping charges, agencies, commissions, etc.

Thus it is seen that we can make our own railroad iron, *if we will, as*

Southern Ohio.

	Tons.	*Cwt.*	
Raw iron stone, $1,50 per ton,	3	00	$4,50
Coal, 100 bushels, or four tons at 3 cents, $0,75 per ton,	4	00	3,00
Limestone, $1,00 per ton,	0	15	0,75
Other charges, labor per ton,			2,50
Total,			$10,75

cheaply as in Wales, and *with works in the Ohio and Pennsylvania coal field, our iron-masters can manufacture and sell on as good terms for railroad companies as the Welsh iron-masters, receiving bonds or credit;* and besides, *they can receive as profit the amount that is now paid by railroad companies for duties, freight, commissions, etc.*

The advantages are greatly in favor of the American manufacturer in the Alleghany and Ohio coal field, if he will invest capital, and put his works in operation.

It has been shown before, that the duties alone paid to the government in a year and a half, $6,800,000, and buried for a time practically in the sub-treasurer's vaults, would put in operation iron works sufficient to furnish for the future the present demand for railroad iron in the United States. The annual amount now paid in cash by railroad companies for duties, freight, commissions, etc., on imported railroad bars, is about $12,400,000; and this amount invested in such iron works for fixed and floating capital, would be sufficient to furnish the present and prospective demand for railroad iron in the United States, entirely independent of foreign railroad iron. This can be done in three years.

Why is it that this matter has not before been understood? The writer's opinion is, that it was because our *capitalists, railroad company directors, legislators*, and some of our *iron-masters** did not understand our RESOURCES, *their* AVAILABILITY, *nor the cost at which railbars could be produced from stonecoal iron.*

The reasons adduced in the first part of the paper on the manufacture of railroad iron in the United States, together with the above, are believed to be the true causes why we are not *now* independent of foreign manufactured railroad iron.

Let our railroad companies foster our own rail mills, and establish others, (which they can do at less cost for their iron than to buy,) what an impulse would be given to business of every kind. If the $12,400,000 now paid to government for duties, and to shipping interests and for agencies, etc., annually, was put in circulation in Pennsylvania and Ohio in the railroad iron business, giving labor to thousands, and consuming much of the produce of our farms, and giving transportation to railroads, canals, and our rivers and lakes, more than a compensation for transportation of agricultural products to Eastern markets is thus diverted.

It is to be hoped that the preceding remarks may arouse the attention of capitalists, and of railroad companies, to the advantages of the United States for the manufacture of railroad iron. Is it not a fine opportunity, that while the amount now paid in cash by railroad companies, $31 to $40 per ton, will pay for producing the railroad bars, the manufacturer can receive $40 more per ton profit in the railroad bonds, which they can convert into money if they choose; and with the duty retained could banish the Welsh bars even from New York; or with the duty remitted could compete on equal terms, even there?

The great advantage, however, of the Western manufacturers is looked upon as being for supplying the thousands of miles of new railway, and the wear and tear of the old, throughout the great Mississippi valley. The advantages for manufacture are here, and comparatively near where wanted, with unrivalled facilities for distribution by 20,000 miles of river navigation, thousands by railroad, and 1000 more by canal and slack-water.

I believe the points are established: 1st, we can furnish railroad bars as cheaply as the Welsh bars are now furnished; 2d, also with as much credit in bonds; we can furnish railroad bars as cheaply as Wales, even if the duty be remitted, and still with a good profit.

* Most of our iron-masters have made only charcoal iron, and those few making stonecoal pig, could get a good price for their product, with little investment of capital.

IMPROVEMENTS IN PUDDLING FURNACES.

Amongst the patents recently specified, is that of Mr. Isaac Hazlehurst, of Ulverstone, Lancashire, iron and steel manufacturer, for "Improvements in the manufacture of iron by blast, and in the construction of furnaces and machinery for the same," which the inventor thus describes:—

The nature of my said invention, and in what manner the same is to be performed, is as follows:—1. The furnace bottom is circular, or nearly so.—2. Certain tools of the nature and character set forth, are adapted and used in a furnace to which blast is applied (as for an air furnace), such apparatus consists of three legs, two being connected to the main leg, or shaft, by a double joint, which, when introduced into the furnace, opens out, and being immediately connected by the coupling-box to the upright shaft, sustained in suitable bearings (as ordinarily practised in mechanism), which being provided with a bevel wheel gearing with another bevel wheel on the horizontal shaft, mounted in suitable bearings (as ordinarily used in mechanism), is thereby driven by steam or water, or other suitable power, causing the aforesaid tool or apparatus to revolve at a proper speed. The legs being equal in length to the diameter of the furnace bottom, the whole of the boiling process can be completed in a very little time, without any manual labor, with the exception of changing the tools, which I effect as easily, and nearly as quick, as the puddler changes the ordinary tools, by means of the lever and guide rods, one of which is connected to the coupling box for connecting or disconnecting when required, whilst the other lever takes out the hot tool, being connected to it by the chain for conveying it to the cooling cistern, and replacing a cold one, the tool being guided in an upright position by a guide rod, its end being of horseshoe shape, for the chains to fall off, whilst the elongated form one side the shaft spindle, without contact therewith. When the boiling is finished, a shorter tool is introduced into the furnace in the same manner. This tool is similar to the former, with this exception—viz., that it has a hole through the head opposite the one in the coupling-box, through which a pin is placed to keep it above the iron. This tool having but one leg, has several prongs attached; whilst the tool is revolving, the puddler, with his paddle, raises up the iron when dropped (as we term it) from the "boil," which comes in contact with the prongs above described, and separates it into pieces preparatory to balling. The manner in which I apply the blast to puddling, heating, and other furnaces, is by a quadron, or T-pipe, with small holes in different positions on the top side, and a larger hole in the end, pointing under the bottom of the furnace-plates. The blast, whether cold or hot, may be regulated by a tap; this pipe is fixed under the bars of the fire-grate, and may be built in the wall of the ash-pit, being more convenient for cleaning the rubbish out. By the above arrangements and process I am enabled to use peat, either raw or charred wood, sawdust, the finest of coal slack, and coke. The benefits of the blast to the heating furnace, for the finishing of iron, are various, the yield being much greater, and the quality amazingly better, especially when heated on a cinder-bottom furnace, it being much softer than can possibly be made when blast is not applied, the article thus made being better adapted for all pure and polishing purposes, and in great demand for all superior articles, such as rollers, rivets, tin-plates, and steel. Another important advantage to be derived from my invention is, that upwards of 8 tons of iron can be made from one furnace, with 30 cwt. of fuel, in the same time that 25 cwts. of iron take by the common process of puddling, especially when run from the blast, or refining furnace, in the liquid state, as, by this latter appliance, the enormous quantity of 5 tons might be made. Anotheri mportant advantage to be derived is, that parties erecting works would save above one half the outlay in the building of furnaces, fewer being required. It will also be evident that the puddler's work will be far less laborious, and would be far better remunerated, with one third of the present price now paid for puddling by the ordinary mode; and it will be evident to all practically acquainted with the

puddling process, the fatigue otherwise attendant would be almost avoided; it being well known, in hot seasons, that the quality of iron is inferior when the puddler is unable to perform his duty from excessive heat. Having now described the nature of the said invention, and in what manner the same is to be performed, I declare that I claim—1. The manufacture of iron by blast in the manner described.—2. Having the furnace bottom circular, or nearly circular.—3. Having puddling tools of the character herein described, whether such tools be introduced through the crown of the furnace, as illustrated by the drawings, or through the bottom plates, or through the doorway, as they may be applied in either way, according to the character of the furnace, though I find the former the most advantageous.—4. The application of blast to the furnace as described, although I do not confine myself to the precise form of pipe for introducing the blast, as given in the drawings, as any form of pipe, provided with small holes, pointing under the furnace bars, with a larger hole under the furnace plate to keep the same cool, might answer.

DILATATION OF CAST-IRON BY SUCCESSIVE HEATINGS.

We reprint the following article from the *Plough, Loom, and Anvil.*—It is of importance to a large number of our readers, engaged in the construction of machinery, especially so, to those engaged in the making of Boilers, Furnaces and Retorts.

The memoirs of the *Societe Industrielle de Hanovre* contain on this subject a short note, which we here present to our readers:

"The remarkable phenomenon that cast-iron presents after being heated, of not returning, on cooling, to its original dimensions, but of presenting constantly an increase of this volume, and, by consecutive heatings and coolings, of acquiring a permanent volume, larger and larger, was first observed by Prinsep, in 1829. This chemist found that a retort of cast-iron, of which the capacity had been measured with care by the weight of mercury it contained, gave the following results. Before even being heated, the retort contained 9.13 cubic feet: and after three successive heatings to the fusing point of silver, the contents was 10.16 cubic inches. The cubic dilatation produced then was 11.28 per cent., or a lineal dilatation of nearly 3.73 per 100. Since this there has been occasion to observe more frequently, and to investigate this property of cast-iron. It has been remarked, in effect, that all grate-bars which sustained a high heat became curved, little by little, that they elongated more and more, until finally they would push out the bars that sustained them.

M. P. W. Brix, in a work he has recently published, entitled *Researches on the Caloric Power of the Principal Combustibles found in Prussia*, has made known some experiments on this subject.—By the aid of numerous measurements, he has found that its permanent length augments after a heating, but that this augmentation was so much the less as the bar had been heated more often, and finally ceased. Thus, a grate-bar of 3.5 feet in length, after three days of a moderate fire, had taken a permanent elongation of 3.16 of an inch, (equal to 0.446 per cent;) at the end of 17 days, this elongation was 7.16 of an inch, (1.042 per cent.,) and at the end of 30 days had reached 13.16 of an inch, (nearly 2 per cent.) and did not yet appear to have attained its maximum. Another bar of the same kind, after a long service, had preserved a permanent elongation of 1.25 inches, or nearly 3 per cent. The bars, while in the fire, experience another elongation, which is temporary, and contract as the heat is diminished: and it may hence be concluded with Mr. Brix, that it is proper to give to each new bar a play, longitudinally, of about 1.25 of an inch, or 4 per cent, to allow for this permanent and temporary elongation. In all cases, it is necessary to make it long enough, that when cold it may not fall between the supports, but in general it seems that not sufficient play is given to bars supported in this manner.

NOTE BY THE TRANSLATOR.—This is a matter very important to be thought of in all cases where cast-iron is submitted to the action of high heat, as furnaces, retorts, boilers, etc., and especially in cases where the cast-iron, in expanding permanently more than the other metal, will give the surface a curved form, and tend to break the rivets, or other parts of the construction, and in certain circumstances might be productive of very inconvenient results. This is very plain to any practical man.

Where the cast-iron part of an engine is riveted to the boiler, as is often the case, the attachments should be made as far as possible, at places not submitted to great changes of temperature; but if this condition cannot be fulfilled, make the attachments in a manner to obviate, as far as possible, the evil referred to. This remark is made, not only with regard to the permanent elongation the cast-iron undergoes, but also with regard to the different degrees of expansion experienced by cast and wrought iron or other metals, by the same increase of temperature. The effects of this are soon noticed in the loosening of joints, warping of surfaces, etc. The intelligent builder with a knowledge of these facts and their extent, can, by the simple laws of common sense, arrange his work properly.

These effects may be noticed in almost every place where cast-iron is submitted to high heats, in retorts, furnaces, etc.: the shoving out of bricks, the pushing aside of supports, and neighboring parts, etc.

IRON ORE IN THE CARBONIFEROUS LIMESTONE AND COAL MEASURE OF IOWA.

Not far from Dam No. 26, and near the line between Sections 10 and 11, Township 77 North, Range 22 West, there are, probably, one or more beds of coal. Within three or four feet of the top of the shale, *i. e.*, at the height of forty or forty-five feet from the Des Moines River, there is, at this locality, a band of ironstone having a specific gravity of 3.45, associated with some sulphuret of zinc, the joints being coated with a crust of silicate of alumina.

The following analysis, by the humid method, gives as follows:—

Bituminous or carbonaceous matter,	01·0
Insoluble earthy matter,	07·6
Carbonate of the protoxide of iron,	65·0
Carbonate of lime,	07·2
Carbonate of magnesia,	10·0
Alumina,	01·8
Peroxide of iron,	04·8
Phosphate of iron,	02·6
	100·0

After pounding and sifting the raw ore, a quantity weighing 1225 grains was roasted and exposed to a red heat in a shallow vessel; after roasting it weighed 865 grains; loss by roasting 360 grains, being equal to 29.4 per cent.

The color, after roasting, was a purple-brown. An assay was then made, in a black lead crucible, at a high temperature, with the following ingredients in the proportion of

Roasted ore,	865 grains
Bottle glass,	865 "
Chalk,	865 "
Charcoal,	134 "

There resulted therefrom a button of light gray iron, weighing 377 grains, equal to 43.5 per cent. of the roasted ore, and 31 per cent. of the raw ore, differing only 2.5 per cent. from the percentage of metallic iron by the humid method. It appears from the above analysis, that this ironstone is very analogous in its composition to the ore known in Scotland as "Mushet's Black Band," the chief difference being a smaller percentage of carbonaceous mat-

ter, and the substitution of phosphorus for sulphur. It is more than probable that a repetition of the analysis of the "Scotch Black Band" would give, also, a small percentage of phosphorus, since Dr. Owen only succeeded in detecting and estimating this element in the Des Moines ore by methods which have been introduced into analytical chemistry within the last few years.

The existence of phosphorus in this ore is not a matter of merely scientific interest, but of practical importance also. Collier and Rinman assert that the "cold-short" property of iron (that is, its liability to become brittle when cold,) is due to the presence of the phosphoret; while Mushet, whose knowledge of iron and its properties is, probably, superior to that of any other writer, doubts the assertion.

It has, he says, been matter of common remark, that iron of the most perfect quality, as the Swedish, gives out, in working, a strong phosphoric smell; and he adds, that any iron can be made cold-short by introducing into the blast-furnace, through the medium of the flues or otherwise, silica in excess.

In support of this view, he remarks, in his work on iron and steel—"The flue cinder of the balling furnace, which on an average contains thirty per cent. of silica, and the flue furnace cinder of the puddling furnace contains forty per cent., while sand bottoms were in use, furnished striking illustrations of that fact. At first, when these cinders, containing from forty to fifty-two per cent. of iron, were returned to be smelted for the production of forge pigs, the brittleness of the iron was so much increased that fears were entertained as to the practicability of their use, and maintaining a marketable quality of iron. The change of system which took place, from puddling on sand to puddling on iron bottom, by introducing a less quantity of silica into the blast furnace, had a great tendency to reduce this evil, and restore fibre to the bar-iron."

And he concludes by saying—"From this fact being so clearly ascertained, we obtain a clue to explain the probable cause of cold-short in iron generally, by attributing it to a predominant quantity of silica in the ore, rather than to the existence of phosphorus."

Here is a marked difference between the opinion of so experienced a man as Mushet and the statement of Renman, made in the summer of 1849, to the British Association, at their annual meeting: the statement, namely, that in every instance in which Swedish iron has proved cold-short, he had been able to detect the presence of phosphorus. To this important subject Dr. Owen invites the attention of American chemists and iron masters. It is only by careful chemical analysis, conducted after the most approved method, tha this moot point can be finally determined. Should phosphorus invariably be found in cold-short iron, while it should prove to be uniformly absent in iron free from that defect, the inference will be a fair one, that phosphorus is the producing cause.

MAGNETIC IRON ORE.

We have recently been shown some fine specimens of Magnetic iron, brought down from the North shore of Lake Superior, by Mr. Wilson of Hamilton, C. W., who is extensively interested in the copper and iron locations of that region. This gentleman took down samples of this ore to be tested in the manufacture of steel. So important is a good quality of iron for this purpose, that the manufacturers, in England, have sent scientific men, this season, to the United States and the Canadas, to examine their iron ores with a view of securing the best Magnetic iron for their business. We have seen the most beautiful iron of this character from both sides of the lake, and it is known to be in various localities and in the greatest quantities.

There is one locality on the North shore where there is a dyke of this iron, perpendicular and jutting out to the lake, some six hundred feet in thickness, which is only equalled in extent, in the world, by the iron mountains of Marquette. The day cannot be far distant when such rich ore will be turned to

a valuable account. We have no doubt this iron will be extensively mined in another year, and the beginning of an immense iron business seen on both sides of the great lake.—*Lake Superior Journal.*

IMPORTS OF IRON.

The total amount of iron shipped to the United States in 1852 was 439,893 tons out of 808,183 tons—the total amount exported in that year from the United Kingdom.

CONVEYANCE OF IRON IN RUSSIA.

The Siberian iron descends the river Don to Rostoff, it is there put into lighters, and conveyed, 60 miles, to Taganrog (a very shallow and inconvenient port on the sea of Azoff), where it is duly landed: and when the right vessel arrives, and anchors 15 miles from the shore, it must be put on board by means of lighters again. In two days after she has been loaded in this expensive way at Taganrog, the ship probably reaches Yeni Kale (at the western end of the sea of Azoff), where the process above described again takes place, and thus the cargo has been subjected to five transshipments before it can be fairly said to have left the Russian shores; a proceeding which affords a rich harvest to a numerous and rapacious crew of Greek lightermen.

COATING FOR IRON AND OTHER SHIPS.

A. Robinson, of London, has taken out a patent for a compound of black lead (plumbago) and asphaltum, to be applied to bottoms and sides of vessels, in a fluid heated state, as a coating or paint. The asphaltum is heated to a fluid state in an iron kettle, then the plumbago at the rate of 2 ozs. to the pound of asphalt is stirred up with it, until it thoroughly incorporates, when it is applied by brushes to the bottom of the ship. If some arsenic is mixed with it, for wooden vessels, it prevents the attack of barnacles.

QUARRIES AND CLAYS.

PORTLAND CEMENT—ITS ORIGIN AND USE.

In all architectural erections, from those which, if they do not constitute, at least evince a nation's greatness, to others of less pretence, cementing materials form a most important element; and among all those which have been submitted to public patronage, and the test of practical experience, perhaps none can be referred to with greater interest, or with more satisfaction as to the results, than the original Portland cement. This cement was originally invented by Mr. Joseph Aspdin, a builder, of Leeds, who having from motives of research analyzed lava obtained from various volcanic districts, and sold as "tarras" and "pozzolano" cements, became impressed with the idea that he had discovered a material superior to all that had then been introduced. By dint of perseverance and inquiry, he discovered the composition of the strata, and how each element was affected by heat from volcanic action, as well as that spontaneously engendered. After much study and numerous experiments, he discovered a material which would set, and become harder than ordinary lime, and by constant application and unremitting exertions during a period of several years, he, in 1824, to insure its protection, took out a patent. He named it "Portland," in consequence of its close resemblance to the stone called by that name. It may be well here to remark, that although this material has been called *artificial hydraulic cement*, the term is only applicable

to imitation Portland cements, or common blue lias lime, sold under the name, but bearing no comparison to the genuine article. After securing the patent, Mr. Aspdin erected a cement manufactory at Wakefield, and his son, Mr. William Aspdin, who is now the sole manufacturer, and was brought early into the business, by close application to the *rationale* of his father's process, has made much further improvement in the article.

The Portland cement had been manufactured seven or eight years before its setting properties and true value began to be appreciated; about which period it arrested the attention of Sir Mark Isambard Brunel, then constructing the Thames Tunnel, who, on experimenting, found it three times the strength of any other cement, and decided on employing it for his purposes, although nearly double the price of the best Roman cement. When the water broke into the Tunnel in 1828, a large quantity of this cement was thrown into the river, effectually closed the cavity, and enabled the contractors to pump out the water, and resume the work. It can be manufactured to set hard under water in one minute, or even less, or such result may be delayed for one or two hours, as most desirable.

Mr. Felix Austin, the artificial stone manufacturer, Regent's Park, having inadvertently allowed some Portland cement to remain in a damp situation two years, it became hardened in the bags: he had it pulverized and mixed with water, in the usual manner, when, to his surprise, in a few days it set as hard as stone, and this may be considered its first introduction into London. Messrs. Wyatt and Parker, the principal Roman cement manufacturers, although the article came in competition with their own, were so convinced of its superiority, that they undertook the agency for its disposal. An increasing demand now took place, from engineers, architects, surveyors, contractors, and builders, and to such an extent that the Wakefield manufactory could not furnish the supply; another was, therefore, established at Rotherhithe; and on Messrs. Grissell and Peto undertaking the contract for the new houses of Parliament, a series of experiments were made under their own superintendence, which clearly showed its superiority. In some cases stock bricks were attached to a wall by their flat sides, and others to them, projecting horizontally, when heavy weights being added until the brick bar thus formed, up to as many as 40 bricks, gave way; in every instance the substance of the brick was torn out, the cemented portion remaining uninjured. In testing also for its adhesive power by the hydraulic press, equally satisfactory results took place. With various mixtures of sand and cement in different proportions, it stood a crushing force of from 18 to 45 tons before giving way; while a block of pure cement, 35 days old, stood a presure of 141 tons without even a flaw.

Mr. Aspdin suggegted the propriety of adopting this cement in the construction of piers, breakwaters, and other hydraulic works, in lieu of stone, and masses of from 5 to 50 tons were constructed, merely of shingle, sand, and cement, which proved harder than any natural material; since which many important works have been completed in this manner, both by English and French engineers. Another important feature in this cement is its indestructibility. Unlike other cements, it neither decomposes by atmospheric or aqueous influences, nor generates mould or other vegetation. It requires no painting, and the longer it is exposed to the action of the weather the harder it becomes; for a demonstration of which fact reference can be made to houses stuccoed with this cement 30 years since, which are still hard as flint, and will strike fire with a blow from a trowel.—*London Journal.*

THE INDURATED STONE COMPANY.

On several occasions, during and since the year 1848, we have called particular attention to and fully described a most interesting process, patented by Mr. William Hutchison, of Tunbridge Wells, for indurating the softest, most porous, and worthless sandstone, and other similar materials, paper, paste-

board, plaster, and other substances, rendering them as hard as granite, perfectly impermeable to water, and totally unaffected by atmospheric or other influences, except actual violence. The operations are at present confined to the works, which were established by Mr. Hutchison at Tunbridge Wells, for the purpose of operating on a soft and porous sandstone, at King's Quarry, from which place there is a railway communication to all parts of the kingdom. Materials particularly suited to this process will be found among the various sandstone formations, the oolites, the chalk, and other tertiary deposits, and even among the more primitive rocks, particularly when in a state of partial decomposition. The invention is, however, not confined to stone in a solid state, as refuse sandstone, or other soft and friable material, may be ground fine, and mixed with loam, and while in a soft state, moulded or cast into any form, and afterwards rendered of almost metallic hardness by the patent process. When we consider that masonry of every shape, the most elaborate architectural embellishments, and every description of decoration, can be produced by the saw and chisel on soft materials in inconceivably less time than in the more durable natural stones and marbles, and that these can be rendered almost indestructible at little cost, it may easily be conceived that the products under this patent will be rendered to the public at something like half the usual price of such commercial commodities. The field of operations is still further extended by its application to paper, pasteboard, or other similar materials, producing a substance beautifully adapted for light roofing, lining damp walls, and other similar purposes, and to papiér maché, and other pulps, after being cast into mouldings, busts, statuettes, and other artistic designs. It will thus be seen that the process is adapted to materials for building purposes, which will exclude all damp, harbor no vermin, preserve timber from decay, produce warmth, and suffer no dilapidation; particularly for hydraulic purposes, bridges, sea walls, docks, tanks, pipes, drains, &c.; architectural and other decorations of every description, to monumental purposes, tombs, mural tablets, hermetically sealed coffins, and in fact, for every use to which marble, stone, slate, and many other materials, have hitherto been indispensable. With respect to color, although black, brown, and white, have hitherto been principally employed, a large variety of colors may be successively produced; and where required, the most finished polish can be obtained. Sir Roderick I. Murchison has recorded a most unqualified favorable opinion of the invention, and expresses his full belief that it only requires to be known to be generally and thoroughly appreciated.—*London Journal.*

PURIFICATION OF GRAPHITE FOR LEAD PENCILS.

This is a method proposed by Runge for purifying impure graphite. The mineral is to be brought to a fine state of division, and then digested with double its weight of concentrated sulphuric acid. The acid is then removed, and the powder washed clean with water. The acid has dissolved out the iron, alumina, &c., and holds them as sulphates. The sulphate of alumina may be separated with profit, if the operations are carried on largely. He proposes to add a small quantity of lampblack in order to give a deeper color to lines made by the pencil. The graphite prepared in this manner is much cheaper than the English black lead, and is full as pure as the best Borrowdale lead.—*Le Technologiste.*

NITRATE OF SODA.

We published in previous pages an article on the supply of nitrate of soda, which may be obtained in the southern part of Peru. Nitrate of soda is a principal ingredient used in the process of Dr. Homer Hallond for the desulphurization of metalliferous sulphurets, which is very favorably regarded for the extraction of gold from pyrites.—The account of Dr. Hallond's process will be found on page 168, vol. iii., of this Magazine.

SULPHURIC ACID.

Mr. Edmund Leyland, of St. Helen's, Lancaster, has patented the construction and application of chambers or vessels of brick, instead of similar erections of lead, in the manufacture of sulphuric acid, or the vitriol of commerce. The bricks employed for this purpose are moulded of any convenient shape or dimensions, and they are composed of such materials as will effectually resist the action of the acid and gases which are incidental to the manufacture of sulphuric acid The materials preferred are similar to those employed in the manufacture of glazed stoneware pipes. It is also found advantageous so to burn such bricks, and so to form them, either as hollow, or perforated, or cellular masses, that they shall be thoroughly vitrified; and provided the shape is not materially injured, the vitrifying process cannot be carried too far, as thorough vitrification is essentially necessary. If glass bricks, of good form, and possessing the necessary resisting powers, could be economically obtained, they would be preferred; but any bricks, of whatever mineral substances they be composed, whether vitrified or not, are suitable and applicable to the improved sulphuric acid apparatus, in proportion to their power of resistance hereinbefore referred to, and their fitness as building materials. In building up such vitrified materials into sulphuric acid chambers, the necessary junctions are effected by the aid of any suitable and convenient materials or cement, possessing the same resisting property as the bricks themselves. It is preferred to construct the chambers of a conical shape, nearly resembling the form of circular pottery ovens; that is to say, with a circular plan, and with a curve, slightly within a catenary curve in mid-sectional elevation,—making the height equal to about 1½ times the greatest diameter. Such erections are fairly equilibrated, and require little or no staying or binding; but where it is necessary to stay such chambers, iron stays or binders, with a leaden covering over them, are used. A leaden bottom is applied to such chambers, the lead being carried under the walls, and rising up outside, so that the walls will virtually stand in a large leaden cup: any liquid, therefore, coming down the inside wall surfaces, or down the body of the walls, may be all caught by this bottom cup. Outside the chamber, and round the bottom thereof, is placed a projection, somewhat higher than the turned-up edge of the leaden bottom, with gutters formed under such projection to convey the rain, falling upon the building, clear away from the leaden cup. To prevent the weight of the walls from squeezing out the leaden bottom on which they rest, very wide footings are set upon the lead, so as to distribute the weight over a superior surface. The leaden bottom may be dispensed with, if very good bricks and cement are used. The gases and vapors are admitted and withdrawn at suitable places, and must be obvious to the practical man; and the chambers are connected with each other, and with any other apparatus, by pipes or ducts of brick, stoneware, or lead. Provision is made, at the bottom of these chambers, for the withdrawal of the sulphuric acid; and lutes or other openings, or whatever other adjuncts may be necessary, must be made of lead or stoneware. Bricks of various kinds have heretofore been used in and about many minor parts and adjuncts of sulphuric acid chambers; and it has also been proposed to employ chambers of bricks, or of iron, to collect and condense any volatile metallic oxides or other compounds, or dust from the burning gases, before their admission into the sulphuric acid chambers. The patentee remarks that he does not claim the use of bricks, or similar materials, for such minor purposes; but he claims—1. the general system of arrangement and construction of apparatus for the manufacture of sulphuric acid, as hereinbefore described.—2. The application and use of brick chambers, for the formation and condensation of the actual manufacture of sulphuric acid.

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